Big Sky Clearwater

RECYCLING MAKES ENE

USE OF RECLAIMED WASTEWATER

FALL 1987

Do you have an interesting story or information you would like to see in this publication? Contributions of articles for the Big Sky Clearwater are gladly accepted. Please call or write to us at the address below.

If you do not wish to continue receiving this publication please send us you name and address so that we can remove your name from our mailing list.

Rick Rosa
Water Quality Bureau
Dept of Health & Env Sciences
Cogswell Building
Helena, MT 59620

The Big Sky Clearwater--for water and wastewater-treatment operators across Montana--is published two times a year by the Water Quality Bureau of the State Department of Health and Environmental Sciences in cooperation with the Montana Section American Water Works Association and the Montana Water Pollution Control Association.

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Reuse of Wastewater

By: Diane Davison
Water Quality Bureau

Water - it's one resource that much of Montana usually has in abundance and at times we take it for granted that "the well will never run dry". But this year mother nature has shown us just how volatile our water resource is. With snow pack levels well below normal and temperatures soaring in the 90's and 100's, our lakes, streams, and reservoirs are already showing signs of the water shortage we may expect in the future. In May many of our streams were at levels one would expect in July. In light of this water supply situation, the necessity to conserve our valuable resource is obvious.

Wastewater is an important element of the total available water supply and many communities throughout the country are taking advantage of this supply. Reuse of treated wastewater is a viable method of water conservation that can be used not only in areas where water is scarce, but also in areas where water is considered to be abundant.

Generally, the four types of wastewater reuse applications are (1) agricultural reuse, 2) industrial reuse, 3) groundwater recharge, and 4) recreational applications.

Reuse of wastewater for recreational purposes and groundwater recharge are not as common as the other two applications. Recreational uses such as development and maintenance of recreational lakes, parks, and golf courses is one example of water reuse. Reclaimed water is also used to artificially recharge groundwater aquifers which can reduce or stop the decline of groundwater levels. Groundwater recharge is used to protect coastal freshwater aquifers from intrusion of saltwater from the ocean. Recharged aquifers are also an excellent storage place for reclaimed waters that can be used in the future.

Industry recycles water in far greater quantities than any other user. Recycled water is used mainly for process and cooling water purposes. Many industries utilize reclaimed wastewater as part of the recycled water.

By far, agricultural use is the most common application of reclaimed municipal wastewater in Montana. Several communities across the state such as Lincoln, Moore, Geyser, and Roberts, irrigate crops with treated wastewater. Although most of these communities are using irrigation as a method of treatment and disposal, the production of crops is an added benefit.

When reclaimed wastewater is used to irrigate hay and seed crops, the irrigation water must receive equivalent to secondary treatment. Disinfection is usually not required, but fencing around the irrigated land must be provided. A 200-foot buffer zone between the fencing and irrigated land must also be maintained. If milking cows or goats have access to the irrigated pasture then the reclaimed water must be disinfected.

Wastewater that is to be used for spray irrigation of food crops requires more stringent methods of treatment. Adequate disinfection of the water is of primary importance. Further reduction of suspended solids, oxygen demand, and microorganism levels may also be required. This treatment level is also required for irrigation of parks, playgrounds, school yards, cemetaries, and other public areas if public access is allowed during the application period. Although this treatment may appear to be excessive for irrigation, many states that have water supply problems find that this is a viable, cost-effective alternative to using potable water.

Most Montana communities that use treated wastewater for irrigation use the water for irrigation of fodder, fiber, or seed crops and not for food crops. Generally, adequate treatment can be obtained with a facultative lagoon system. The lagoon system not only provides treatment but also provides the storage capacity needed for the winter months.

The main concern of using reclaimed wastewater is the associated health risks and exposure to the microbial and chemical elements of the reclaimed water. Human exposure to reclaimed wastewater can occur through bodily contact, ingestion of contaminated water or food, or inhalation of aerosols.

The level of treatment the wastewater receives will determine how the water will be used. Conventional primary and secondary treatment processes can remove up to 90% of bacterial and viral agents. Additional treatment processes such as disinfection, chemical coagulation and sedimentation, and filtration will result in even higher removal rates.

As we realize that our water supply is a resource that must be preserved and protected, the need to cleanse and reuse the water is evident. Nature has always purified water through natural processes. By following her example we will be able to reclaim the water that has been used by man and ensure that we will always have an abundant water supply.

If you have any questions regarding the reuse of your community's municipal wastewater call the Water Quality Bureau at 444-2406. They will be able to answer your questions regarding the quality required to reuse wastewater for the various purposes you may have in mind for your community.

OPERATOR OPENING!

The City of Forsyth, Montana is seeking a Class I Certified Water Treatment Operator for a conventional treatment facility. Full time position. Wastewater experience desirable. Salary commensurate with experience and education. EOE. Contact: Dan Watson, City Clerk, at 356-2521 or submit resume to City of Forsyth, Forsyth, Montana 59327.

Operators Pass Certification Exams

Seventy-eight persons passed examinations to become water distribution (A), water plant (B), or wastewater plant operators (C) at the last scheduled examination on March 13, 1987. Those passing are listed below.

To be fully certified an applicant must pass examinations indicating proficiency in certain aspects of chemistry, bacteriology, and hydraulics in addition to experience requirements specified for each classification level. Those who pass the examinations but have insufficient experience are certified as operators-in-training. (OT) The next scheduled examinations will be September 18 in Bozeman. The examination notice in this issue gives pertinent information to potential examinees.

CLASS 1:
Pam Anderson, Havre, 1C-ot
Fred Bailey, Helena, 1C-ot
*Roger Bidwell, Great Falls, 1B-ot
*Lynn Blatter, Glasgow, 1A-ot,1B
Chris Blickfeldt, Boise, Id., 1C-ot
*Stephen Feger, Hardin, 1B-ot
Kenneth Finley, Chinook, 1B-ot
Barry Helmbrecht, Billings, 1B
Dennis Holten, Columbus, 1A-ot
Kay Jensen, Divide, 1A
*Richard Koehn, Billings, 1B-ot
Nilaksh, Kothari, Billings, 1B-ot
Svend Larsen, Havre, 1C-ot
Paul Lear, Havre, 1C-ot
David Mell, Bozeman, 1A
Robert Meyer, Havre, 1C-ot
*Stan Nelson, East Glacier, 1A-ot
Robert Porter, Billings, 1C-ot
Grace Ann Rixen, Havre, 1C-ot
Noyam Seltzer, Boise, Idaho, 1C-ot
*Alan Towlerton, Billings, 1A
Kevin Townsend, Bozeman, 1A
Everett Weniger, Havre, 1C
Michael Zabrocki, Billings, 1C

CLASS 2:
Chris Blickfeldt, Boise, Id., 2C-ot
Rita Graham, Kalispell, 2C-ot
Dennis Frickel, Laurel, 2A
*Timothy Miller, Polson, 2C-ot
*Leland Leivo, Bigfork, 2B
Michael Pope, Mountain Home, Id., 2C-ot
*Lyle Rich, Babb, 2C
Noyam Seltzer, Boise, Id., 2C-ot
*Wayne Solum, Poplar, 2A3B
Lloyd Thompson, Sidney, 2A3B-ot
Daniel Turner, Columbia Falls, 2A
*Donald White, Sidney, 2A
Redmond Wyatt, Missoula, 2C

CLASS 3:
Danny L. Anderson, Poplar, 3A4B-ot
*John M. Demarais, Malta, 3B
William Herrington, Townsend, 3A4B
Dennis Lindberg, Helena, 3A4B
William E. Smith, Corwin Springs, 3AB,3C
Brian Solberg, Big Sandy, 3AB-ot
James J. Rusinski, Anaconda, 3C-ot
*George Thompson, Lakeside, 3C-ot
Wayne Turner, Big Sandy, 3AB-ot

Class 4:
Charles E. Allen, Winnett, 4AB,4C-ot
*John Babon, Missoula, 4AB
Jerry Case, Great Falls, 4AB
Larry Emmett, Carter, 4AB,4C
*John Fields, Missoula, 4AB
John R. Field, Big Sandy, 4C-ot
*Ronald D. Hildebrand, Worden, 4B, 4C
Greg Houska, Missoula, 4AB
*Jim Jenson, St. Ignatius, 4C
*Chuck Jorgenson, Billings, 4AB
*Frank J. Leenknecht, Billings, 4AB
Dennis O. Lindberg, Helena, 4C
Jeffrey Nelson, Lakeside, 4AB, 4C-ot
Edward J. Marn, Belt, 4C
Fred Minear, Paradise, 4AB
Marshall Myers, Eureka, 4AB
Merl Phillips, Kalispell, 4C
Claude Sims, Missoula, 4AB
Brian W. Solberg, Big Sandy, 4C-ot
*Joseph Tackes, Power, 4C
Lloyd Thompson, Sidney, 4C
Wayne Turner, Big Sandy, 4C
James R. Vest, Westby, 4AB-ot

Class 5:
Marvin Beam, Miles City, 5AB
William Davison, Kalispell, 5AB
Ron Hagerty, Jefferson City, 5AB
James D. Hutchison, Lolo, 5AB
Kathy Hutchison, Lolo, 5AB
Richard Johnson, Billings, 5AB
James M. Kallem, Glasgow, 5AB
Glenna Lee, Glendive, 5AB
Duane Lien, Polson, 5AB
Ann Martinson, Kalispell, 5AB
William F. Morris, Missoula, 5AB
Merl Phillips, Kalispell, 5AB
Roger Poeschl, Whitefish, 5AB
Donald Schultz, Lolo, 5AB

Energy Savings at the Miles City Wastewater Treatment Plant

By: Mark L. Richardson
Wastewater Treatment Plant Superintendent

If you are a Wastewater Treatment Plant (WWTP) Operator you are probably working at one of your city's largest electrical users. This was the case in Miles City in 1986 when we began an energy conservation program at the Wastewater Treatment Plant. Electrical costs were competing with wages and benefits as the single highest annual budget outlay. As we would all rather see some of that utility cost move to the wages and benefits column of the budget, the energy conservation program became a high priority.

The first step in developing a program began with gathering and analyzing the previous years utility bills. Montana Dakota Utilities (MDU), the local electrical supplier, was very cooperative in this phase of the project. As we sat down together and began to review all the data, the representative of MDU noticed something very significant. The Miles City WWTP was being overcharged! Upon completion of construction of the WWTP in 1981, the utilities were transferred from the general contractor's name to the city of Miles City. However, the rate was inadvertently left at that charged the contractor instead of the municipal pumping rate that should have been used for the city's WWTP. The previous five years electrical bills were re-calculated at the correct rate and we were presented with a rebate check for approximately $56,000.00. See, there's nothing difficult about this energy conservation stuff. A couple of hours work and we're already $56,000.00 ahead of the game. At this point I tried to convince the City Council that I undertook this project on a commission basis. No luck.

The next step was identifying the major consumers of electricity at the WWTP. The Miles City WWTP consists of a mirror-image double oxidation ditch capable of treating flows varying from .75 to 3.0 MGD, with an average daily flow of approximately 1.5 MGD. While quite efficient and producing a high quality effluent, oxidation ditches can be very energy intensive. Brush type mechanical aerators are used to transfer oxygen and provide mixing at the Miles City WWTP. Each oxidation ditch has two brush type rotors, with each one powered by a 50 hp motor. Since only one oxidation ditch at a time is presently utilized, we have two 50 hp motors running continuously. The only control over hp demand of the aerators we have is the adjustable outfall weir that when raised or lowered, raises or lowers the water level in the oxidation ditch; thus adjusts the depth of submergence of the rotor blades. The deeper the blade submergence, the more oxygen transferred and the greater the mixing action. This also creates more resistance on the motor and results in an increased energy consumption.

We considered placing the rotors on timers to allow them to run intermittently; thus reducing our largest energy consumer. After checking with the rotor manufacturers' we learned that this would result in a significantly shorter life span of the bearings and gear boxes. Another factor involved in the decision to cycle the rotors on and off was the concerns we had with achieving proper mixing. Because our oxidation ditches are fairly deep (10 foot water depth) we feel we need both rotors working constantly to maintain adequate mixing. Because of these factors and the importance of dissolved oxygen to the treatment process, we decided to attempt to conserve energy elsewhere in the plant.

For quite some time at the Miles City WWTP we've been working on an alternate method of sludge disposal. Like many activated sludge wastewater treatment plants, sludge handling seems to be the weak point in design of our system. The Miles City WWTP was designed with an aerobic digester and six drying beds with an aerated sludge storage basin for the winter months when the drying beds are unusable. In eastern Montana the "winter months" can sometimes be five months long. Aerating a sludge storage basin for five months can be quite expensive.

With the Water Quality Bureau approving the plans, we developed a system of sludge disposal using two large Rainbird irrigation type sprinklers. The digested sludge is pumped from the aerobic digester through a six inch pipe to the two 1.1" diameter sprinklers located in the adjacent old city sewage lagoons. The pipes were laid to grade so they can be drained back to a wet well at the treatment plant after each use; thus allowing us to use the sprinkler system year round without fear of frozen pipes or valves. Surprisingly there is no significant build up of solids onto the lagoons under the sprinklers.

By taking the two blowers used to aerate the sludge storage basin out of service, we are saving approximately $7,000.00 per year on our electrical bill and eliminating the man hours required to clean the drying beds.

Wastewater treatment plants may be large consumers of energy, but with some careful planning, they can also be candidates for large energy savings.

Miles City's oxidation ditch wastewater treatment facility.

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Miles City's aerated sludge storage facility.

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Sludge disposal in action.

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Sam Pettigrew showing the Rainbird Sprinkler at Miles City.

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Unique Training Experience
54th Annual Operators School

Dates: September 14 to September 18
Place: Strand Union Building, Montana State University, Bozeman
Registration: 8:00 to 9:30 a.m. on September 14 **(NO PREREGISTRATION)**
Cost: $50 (payment to MSU)
CEC's: up to 2.5

We are pleased to announce the Fifty-fourth Annual Operators School to be held from September 14 to September 18, 1987 at Montana State University in Bozeman, Montana. This year's school will include topics presented by nationally-known experts complimented by sessions giving Montana's own experiences. In addition to the general sessions, sessions for operator study (SOS) have been scheduled. The SOS will offer individual instruction in solving math, chemistry and hydraulic problems encountered in the day-to-day operation of water and wastewater systems. All of the sessions will be of great help to those planning to take the Operator's Exam on Friday, September 18 or at other scheduled times throughout the year.

The operator certification exam is administered separately from the Operator's School. You do not have to take the exam if you attend the Operator's School, nor do you have to attend the Operator's School in order to take the exam. However, you should find the exam much easier after four days of intense study at the school. If you wish to take the exam, you must contact Rosemary Fossum, DHES, Water Quality Bureau, Cogswell Building, Helena, MT, 444-2691.

As a reminder, attendance at the Operator's School will satisfy the continuing education credits required by June 30, 1988 for all operators. (See CEC article elsewhere in this issue.)

This year's registration fee is $50. Checks and purchase orders should be made out to Montana State University and be brought to the school; there is no preregistration. This year's school will be held in the Strand Union Building (SUB). Each person will have to make his/her own arrangements for lodging and meals.

We are expecting an informative, useful and exciting school this year. Hope to see you there!

For further information contact:

Denise Ingman or
Dick Pedersen
Water Quality Bureau
Department of Health and
Environmental Sciences
Cogswell Building
Helena, MT 59620
444-2406

Howard Peavy
Water Resource Center
309 Montana Hall
Montana State University
Bozeman, MT 59715
994-6690

Fifty-Fourth Annual School Agenda

September 14-17, 1987

MONDAY -- 9-14-87

8:30-9:30 Registration

9:30 Welcome - Dave Gibson
Response - Steve Pilcher
Operator Certification - Rosemary Fossum
Continuing Education Program - Denise Ingman/Dick Pedersen

10:15 Break

10:45 Communications: How to talk to your elected officials - Ken Weaver and Judy Mathre, MSU

11:45 Lunch

WASTEWATER		WATER	
1:00	Wastewater Treatment, Processes & Operations - Howard Peavy, MSU	1:00	Water Treatment, Processes & Operations - Bob Butcher, City of Blgs
		2:15	Opitimizing Process Control -Bob Kruse, City of Red Lodge
3:00	Break	3:00	Break

JOINT SESSION

3:15 Microbiology for Water & Wastewater Operators - Martha Dow, NMC

4:15 SOS

5:00 Happy Hour - Hosted by AWWA and WPCF

TUESDAY -- 9-15-87

WASTEWATER		WATER		WATER	
8:00	Solids Handling - Al Wallace, University of Idaho	8:00	Wells - Operation & Maintenance - Henry Johnson, Rural Water	8:00	Advanced Water Treatment - A. Amirtharajah Georgia Tech
10:00	Break	10:00	Break	10:00	Break

10:30	Solids, cont.	10:30	Math Review for Small Systems - Ray Wadsworth, Rural Water	10:30	Adv. Water, cont.
12:00	Lunch	12:00	Lunch	12:00	Lunch
1:00	Aeration Systems in Montana - Scott Anderson WQB	1:00	Leak Detection- Ray Wadsworth, Rural Water	1:00	Leak Detection- Ray Wadsworth, Rural Water
2:30	Break	2:30	Break	2:30	Break
2:45	Optimizing Operations at Stevensville - Dick Pedersen, WQB; Bruce Park, City of Stevensville	2:45	Helpful Hints for Small Water Systems - Jerry Burns & Jim Melstad, WQB	2:45	Polymer Use & Evaluation - Bob Butcher, City of Blgs

WEDNESDAY -- 9-16-87

	WASTEWATER		WASTEWATER		WATER
8:00	Developing A Process Control Program - Bob Hegg, Process Applications; Dick Pedersen WQB	8:00	Lagoons - Doris Roberts, NMC	8:00	Chlorination - Ken Johnston
10:00	Break	10:00	Break	10:00	Break
10:30	Using Sludge Accountability As An Operational Tool - Bob Hegg, Process Applications; Dick Pedersen WQB	10:30	Math Review for Small Systems - Doris Roberts, NMC	10:30	Groundwater & Sources of Contamination John Arrigo, WQB
				11:15	Operator Advancement Program - Leonard Willett City of Helena
12:00	Lunch	12:00	Lunch	12:00	Lunch
1:00	Preventive Maintenance - City of Helena			1:00	Amendments to the Safe Drinking Water Act - Dan Fraser, WQB
				1:45	Algae in Public Water Supplies- Loren Bahls, WQB

2:45	Operator Exposure to Infectious Disease - Bob Hunter, MSU	2:45	Basic Telemetry for Water Systems - Eric Campbell, Industrial Technology, Inc

THURSDAY -- 9-17-87

JOINT SESSION

8:00	Confined Space Entry - Ted A. Pettit, NIOSH
10:00	Break
10:30	Distribution & Collection Systems - Installation & Maintenance - City of Billings
12:00	Lunch
1:00	Pumps for Water & Wastewater - Warren Lindeke, Layne Minn. Co.
2:30	Break
2:45	Recognizing & Correcting Cross Connections - Rick Rosa, WQB
3:30	SCHOOL ENDS / SOS

Correspondence Courses

The office of Operator Training at Clemson University offers three correspondence courses for water treatment plant operators and three for wastewater treatment plant operators. The courses are designated B, C, and D, with D the most elementary and B the most advanced. All water courses are $25 each while the wastewater courses range from $30-60. To aid the operator in becoming more knowledgeable and efficient in his job, an additional series of correspondence courses directed toward specific areas of wastewater treatment is available. The first course in this series was developed for the package treatment plant operator; the second in the series is for those operating stabilization ponds.

Each correspondence course consists of instructional material, a test booklet, and answer sheets. The student progresses at his/her own rate; no time limit for completion is set. Answer sheets may be sent in for grading, either individually or in groups. Upon completion of each course, a certificate is issued and students are awarded Continuing Education Units (CEUs). A person's CEUs are permanently recorded by the University Registrar.

For further information, contact Patsy Phillips, Office of Operator Training, Clemson University, 401 Rhodes Center, Clemson SC 29634-0919, (803)656-5574.

*Note: *The department will approve the courses above by crediting CEC's to the same level as the CEU's awarded.*

Examination Notice

ON FRIDAY----------SEPTEMBER 18, 1987----------8:30 A.M. TO 12:30 P.M.

IN BALLROOM B, STRAND STUDENT UNION BUILDING, MSU CAMPUS, BOZEMAN, MONTANA

examinations for certification as a Water Distribution Operator, Water Plant Operator, and Wastewater Plant Operator will be administered.

The examinations will be given at the conclusion of the annual Water School to be held on the MSU campus September 14 - 17. Attendance at the school is not required in order to take a certification examination. However, anyone planning to take an examination should complete a certification application AND examination registration slip before September 4, 1987 and send it to:

Water/Wastewater Operator Certification
Water Quality Bureau - Room A206 - Cogswell Building
Helena, Montana 59620 (Phone: 444-2691)

Annual fees for fiscal year 87/88 payable with application are: Class 1-$27; Class 2-$22; Class 3-$17; Class 4-$12; Class 5-$10. There is no pre-registration for Water School. Fees for the school are payable to MSU at the time of registration September 14, early a.m. Water School information will be in the August CLEARWATER.

Those who have previously submitted certification applications and fees for fiscal year 87/88 will only need to submit EXAMINATION REGISTRATION SLIPS (detachable below) with a fee of $5 per examination. PLEASE RETAIN THE UPPER PORTION OF THIS NOTICE to know the time and place of the examination. Checks should be made payable to: DHES - OPERATOR CERTIFICATION. For application materials or information contact the address or phone listed above.

EXAMINATION REGISTRATION SLIP

(Detach and return with $5 per exam by September 4, 1987)

I will take the examination(s) I have checked below:

Type	Class: 1	2	3	4	5
Water Distribution (A)	____	____	____	____	____
Water Plant or Well (B)	____	____	____	____	____
Wastewater Plant (C)	____	____	____	____	____

*Combination examinations are offered for 2A3B, 3A4B, 4A4B, and 5A5B and require $5 examination fee remittance only.

NAME:_____ ADDRESS:_____

SYSTEM OPERATED:_____

ANSWERING YOUR QUESTIONS ABOUT CONTINUING EDUCATION CREDITS

ROSEMARY FOSSUM
OPERATOR CERTIFICATION
WATER QUALITY BUREAU

What do I have to do to earn a CEC?

Either by correspondence or in person, you must complete a course which is relevant to your certification. The course must be approved by the department for a stated number of credits or part-credit according to the number of contact hours required to complete the course.

How do I report the CEC's I have earned?

By sending the CEC report form (reprinted in this issue of the CLEARWATER) to the certification office.

How many CEC's do I have to earn?

Class 1 fully certified operators in either water distribution or water treatment or both must earn 1 CEC (10 contact hours) per two years. Class 1 fully certified operators in wastewater treatment must earn 1 CEC per two years. Class 2 or 3 or 4 fully certified operators in either water distribution or water treatment or both must earn 1/2 CEC (5 contact hours) per two years. Class 2 or 3 or 4 fully certified operators in wastewater treatment must earn 1/2 CEC per two years.

What is the cut-off date for reporting CEC's?

June 30, 1988, is the end of the first two-year period for reporting CEC's. For succeeding two-year periods, it will be June 30, 1990, then June 30, 1992, etc. However, the best time to report CEC's is RIGHT AFTER you earn them!

If I attend a course for which CEC's have been approved, will I automatically be be given the CEC credit?

Not unless you fill out a CEC report form signed by the instructor and get it back to the person in charge of sending the report forms to the certification office, or send it back to the certification office yourself.

If I am a Class 5 operator or an operator-in-training, do I have to earn CEC's?

No you don't. However, if you are an operator-in-training for one classification and fully certified in another classification, you must, of course, fulfill the CEC requirements for the classification in which you are fully certified.

Suppose I know of a course I want to take but know that it hasn't been approved by the department. Could I get it approved?

Maybe. First, the course has to be somehow relevant to the operation and maintenance of water distribution systems, water, or wastewater plants. Second, you must supply a complete course outline plus information on the course instructor or sponsor (address/qualifications), the date(s) of the course, the number of hours required to complete the course, the fees and prerequisites required. The APPLICATION FOR APPROVAL OF TRAINING FOR CONTINUING EDUCATION CREDIT, which requires this information, is the form used for course approval by the department.

Do correspondence courses have to be approved too?

Yes, any course for which CEC credit is given must be first approved. To date, applicable correspondence courses at California State U. (Sacramento), Michigan State U., TPC Training Systems, and Clemson U. have been approved.

Can I get CEC's for attending applicable seminars out of state?

Probably, if you can supply complete enough information to satisfy the approval process and can verify your attendance by obtaining the signature of the instructor or by providing a photo-copy of a certificate of course completion.

Can CEC's be earned by training given "in-house" to all the personnel in a plant?

Yes, if the training is applicable and has been approved by the department.

Is it true that I can earn CEC's by teaching an approved class to other operators?

Yes. We believe organizing course content and materials and then presenting them in ways that will instruct a group IS a learning experience worthy of credit. The instructor must first complete the APPLICATION FOR APPROVAL OF TRAINING FOR CONTINUING EDUCATION CREDIT to secure department approval, and then must report the CEC earned from teaching on the CEC report form.

Can you send me a list of training courses which are approved for CEC's?

A training calendar is published in the CLEARWATER twice each year. Two to four weeks in advance of each seminar, operators in nearby areas will be sent specific agendas. Operators will receive similar notice of any newly added seminars.

Can surplus credits earned during one reporting period be carried over to the next reporting period?

No, but they will be credited to your CEC records in that reporting period.

What if I miss out on all opportunities to earn CEC's?

Your certificate(s) would then expire on June 30 of the reporting biennium. If you passed the appropriate examination(s), the certificate(s) could be reissued. Extensions of time of up to one year within which to fulfill your credit requirements may be approved for individual cases which involve documented hardship or extenuating circumstances. Requests for such extensions must be made prior to March 31 of the reporting biennium.

I am an operator for a trailer court serving water to fewer than 100 people but have been certified for years as a Class 4 water operator. Do I still have to earn CEC's?

Yes, if you wish to retain your Class 4 certificate. But you may return your Class 4 certificate to the certification office and request to be reclassified as a Class 5 water operator since your system is now classified as a Class 5 system. All operators were given an opportunity to request reclassification in 1982 when the certification classes were reclassified according to the kind of system operated. At that time most operators chose to retain their original classification. But it's never too late to request a reclassification.

Who keeps track of all the CEC credits I've earned and reported?

The certification office and its trusty computer will and if you are wise, you will keep track, too! And if you have more questions, please don't hesitate to call 444-2691 or write the certification office at Room A206, Cogswell Building, Helena, Montana 59620.

MONTANA - CONTINUING EDUCATION CREDIT REPORT FORM FOR WATER/WASTEWATER OPERATORS

MAIL COMPLETED REPORT TO:

WATER/WASTEWATER OPERATOR CERTIFICATION
ROOM A206 - COGSWELL BUILDING - HELENA 59620
PHONE: 444-2691

OPERATOR NUMBER: _____

CERTIFICATION: _____

CREDIT EARNED: *(leave blank)*

NAME: _____ ADDRESS: _____

CITY: _____ STATE _____ ZIP: _____ PHONE: _____

NAME OF SYSTEM OPERATED: _____

TITLE OF TRAINING COURSE: _____

NAME OF ORGANIZATION OFFERING THE COURSE: _____

NUMBER OF CREDITS APPROVED FOR THE COURSE: _____

CREDIT APPLIED TO: *(check one below)* _____

WATER DISTRIBUTION/WATER PLANT ☐ WASTEWATER PLANT ☐

DATE AND LOCATION ATTENDED: _____

NUMBER OF HOURS ATTENDED: _____

SIGNATURE OF INSTRUCTOR: _____

SIGNATURE OF OPERATOR: _____

COMMENTS ON TRAINING COURSE: *(for optional use by operator)* _____

NOTE: *Correspondence or self-study courses approved by the Department of Health and Environmental Sciences should be reported on this form. The instructor would be the person approving the course assignments.*

Another Bug In The Water?

We're Sick of It!

By: Donna Howell
Water Quality Bureau

Cryptosporidium, another intestinal parasite, has now joined Giardia on the waterborne disease scene. This "new" bug has been identified as the cause of a major waterborne disease outbreak in Georgia last January, and is the suspected cause of a few other water-related outbreaks across the country. Cryptosporidium has been around for a long time, but it has only been recently (since 1976) that we found it caused illness in people, and only during the last few years that we learned it could be transmitted by drinking contaminated water.

Not all the specifics are known about Cryptosporidium's life cycle, but we do know it is more complex than that of Giardia. Cryptosporidium is like Giardia in many ways. They both infest the gastrointestinal tract, multiplication of the organism only occurs inside the infected individual, they produce similar disease symptoms, and they are transmitted through ingestion of a cyst-stage (an "oocyst" for cryptosporidia). Oocysts are present in the stools of infected individuals and can survive for 2-6 months in moist environments.

In addition to diarrhea and cramps, symptoms caused by Cryptosporidium include vomiting and low grade fever in some people. Unlike Giardia, infections by Cryptosporidium usually self-cure so you can often get over the disease within a few weeks. This is fortunate, because we don't currently have a proven treatment for it. Immune-compromised individuals generally have a much harder time shaking their infections, and the parasite can cause more problems for them.

The first known infections of Cryptosporidium in humans were associated with exposure to farm animals. Calves, lambs, pigs, and chickens can carry it, and a few reports have described infections in dogs and other domestic and wild animals. Daycare center outbreaks have also occurred because of the ease with which this organism is transmitted by person-to-person contact.

We know Cryptosporidium occurs in Montana. Dr. Jack Rhyan, with the Dept. of Livestock Diagnostic Laboratory in Bozeman, has found Cryptosporidium in 9% of 111 calves he has looked at during the first 5 months of this year. His studies concentrate on death-losses of livestock, so the incidence of the parasite in other cattle across the state is not known. The microbiology lab in Helena has had one positive human diagnosis since they began looking for it in 1985.

The fact that only one human case has been found in Montana so far may be a misleading indicator of the degree of the problem. Stool samples from both humans and animals with Cryptosporidium infections might not be sent in for diagnosis since they usually do self-cure, and physicians need to specifically request the test for the oocysts because diagnosis requires a special analysis method. It is also possible our national preoccupation with Giardia has made us neglect Cryptosporidium as a possible cause of similar disease symptoms.

The Water Quality Bureau has not been looking for Cryptosporidium oocysts in surface water. The detection method requires the same sample collection and preparation procedure as Giardia, but Cryptosporidium oocysts are 4-6 micrometers in diameter (about half the size of Giardia cysts) so they are difficult to see and to verify. We may begin a surveillance program if the need arises, but in the meantime we assume this parasite can occur in all of our surface water supplies. Water suppliers using surface sources must be prepared to remove or destroy it at all times.

To protect against waterborne outbreaks of Cryptosporidium, filtration plants must rely on the same degree of treatment as required for Giardia. That is, minimizing turbidity breakthrough and optimizing filter performance. Preliminary studies on chlorination have indicated this organism is **very** resistant to disinfection, even more than Giardia cysts. We do not know how effective ozonation or chlorine dioxide application will be against it. We also do not know what, if any, affect Cryptosporidium will have on the 1986 Safe Drinking Water Act Amendments addressing mandatory filtration of surface waters.

The waterborne outbreak in Georgia occurred through a conventional filtration plant where operational practices were compromising effluent quality. Dirty filters were placed into service without being backwashed, turbidity monitoring did not detect the poor effluent from some of the filters, and flocculation was bypassed while a new system was being installed. Post-filtration chlorination was not able to destroy the parasite so several thousand people became ill. This is an example of what can happen to a water supply when treatment isn't carefully controlled, and it reminds us of the importance of keeping a close watch on our own systems.

User Cost Survey Coming ! ! !

By: Scott Anderson
Water Quality Bureau

The Water Quality Bureau will be mailing a survey form to all public water and sewer systems in the state within the next few months. This survey will evaluate user rates for water and sewer service on a statewide basis. This data will be used to determine the range of utility costs and assess areas of need where costs are excessive. The information may become valuable in obtaining financial assistance from the state legislature. Please participate by completing the form and mailing it back to the bureau.

Lawn & Garden Irrigation --

How Big a Factor is it?

By: Roy A. Wells
Water Quality Bureau

As summer comes around again we are reminded of the demand that irrigation places on water systems. The reminders come in the form of watering restrictions and consumer complaints. It is generally agreed that irrigation demand is significant. The question is: how big a factor is it? To answer that question, the following analysis is presented.

To begin our analysis we have to make some assumptions, i.e.

1. Domestic demand (Q_{dom}) is the quantity of water used daily within a dwelling unit.

2. The dwelling unit (DU) is occupied by three persons.

3. Each person uses 100 gallons per day within the dwelling.

4. The dwelling unit is located on a 75-foot wide by 100-foot deep lot with a total area of 7500 square feet.

5. The lawn and garden have an area equal to 5000 square feet.

6. Irrigation water (Q_{irr}) equal to 1.5 inches per week is applied to the entire lawn and garden area.

7. Total demand (Q_{total}) is equal to the sum of the domestic demand and the irrigation demand.

After having made the above assumptions we can proceed to make the following computations.

$$Q_{dom} = \frac{3 \text{ persons}}{1 \text{ DU}} \times 100 \frac{\text{gallons}}{\text{day person}} = 300 \frac{\text{gallons}}{\text{day DU}}$$

$$Q_{irr} = 5000 \frac{\text{ft}^2}{\text{DU}} \times 1.5 \frac{\text{inches}}{\text{week}} \times \frac{1 \text{ ft}}{12 \text{ inches}} \times 7.48 \frac{\text{gallons}}{\text{ft}^3} \times \frac{1 \text{ week}}{7 \text{ days}} = 668 \frac{\text{gal}}{\text{day DU}}$$

$$Q_{total} = Q_{dom} + Q_{irr} = 300 \frac{\text{gallons}}{\text{day DU}} + 668 \frac{\text{gallons}}{\text{day DU}} = 968 \frac{\text{gallons}}{\text{day DU}}$$

Comparing total demand including irrigation (Q_{total}) and demand without irrigation demand (Q_{dom}) yields the following.

$$\frac{Q_{total}}{Q_{dom}} = \frac{968 \text{ gallons/day DU}}{300 \text{ gallons/day DU}} = 3.2$$

From the above comparison it can be seen that the total demand which includes irrigation is 3.2 times the demand without irrigation. This comparison answers the question asked at the beginning of this article, i.e. How big a factor is irrigation? The answer is "big"!

It needs to be noted that the preceding example used a fairly modest sized lot. Large lots with more irrigation area will obviously make the factor even bigger.

The example was limited to daily flows. It did not address the fact that domestic demands and irrigation demands are not uniform throughout the day. The maximum demand for both often occurs at the same time of the day. This can cause significant problems for systems with undersized water mains or inadequate storage.

The assumptions and computations were provided to allow the reader to substitute values that are more appropriate for his or her own system or home.

1986 AWWA Water Quality Technology Conference Was A Success

By: Donna Howell
Water Quality Bureau

Each year the National American Water Works Association sponsors this conference to specifically address current water quality issues. The majority of the conference attendees and participants are water utility personnel, chemists, microbiologists, and researchers actively investigating a variety of water supply topics.

The theme of last years AWWA WQTC was "Advances in Water Analysis and Treatment". This theme reflected the nation-wide concern for improving the quality of our potable water supplies and increasing the reliability of our monitoring systems.

Presentations at the conference included microbiological and chemical sampling methods and analysis, handling the news media when your system is in the spotlight, unique utility programs to deal with operating problems, and getting useful information out of water quality testing.

Another area receiving a lot of attention was the 1986 Amendments to the Safe Drinking Water Act. Conference attendees heard both sides of the arguments over mandatory filtration of surface water supplies and mandatory disinfection of groundwater systems. The proposed organic contaminant monitoring requirements were also discussed, with many small utilities questioning their ability to fund these analyses.

Over 180 authors contributed to the diversity and success of the conference. Several of the presentations were from Montana participants. Dr. Gordon McFeeters, professor of Microbiology at MSU, presented a paper on their work on the health significance of injured bacteria in drinking water. Donna Howell presented a paper on Montana's program to evaluate filtration plants for their ability to remove Giardia cysts. Dr. Hunt, from MSU's Civil Engineering Department, talked on his studies on modeling chlorine residuals in distribution systems. E. van der Wende, also from MSU, presented a paper on biofilm and regrowth in distribution systems.

The Water Quality Technology Conference is held each fall at different locations across the U.S. This year the conference will be in Baltimore, Maryland on November 15-18. These conventions have a lot to offer water supply professionals. Not only is it an excellent way to keep up with the most recent research and regulatory news, but it also allows you to discuss water supply problems with people from every state, Canada, and other nations. If you get the chance, you'll probably find attending a WQTC to be well worth the effort.

1987 MSAWWA/WPCA Joint Conference
Education, Entertainment, Exchanging Ideas & Experience!!

New inductees into the Select Society of Sanitary Sludge Shovelers.

Drinking water Taste Test won by the city of Great Falls against tough competition.

Attendees enjoy social mixing sponsored by conference exhibitors.

Join Us Next Year In Helena

March 16-18, 1988

Dan Fraser received Fuller Award at the conference banquet.

Dan Fraser Receives Fuller Award

Dan Fraser with the Water Quality Bureau of the Department of Health and Environmental Sciences was the recipient of the Fuller Award for 1987. The George Warren Fuller Award is given to a member of the Montana Section of the American Water Works Association each year for distinguished service in the water supply field.

Dan has been involved with public water supplies since his employment with the Water Quality Bureau in July 1976. During the first part of that time period, he was instrumental in the preparations necessary for Montana to accept primacy for enforcement of the provisions of the Safe Drinking Water Act. He helped to put together the regulations for incorporation into Montana law and developed the public water supply program from its infancy to its present status.

Since being put in charge of the public water supply section of the Water Quality Bureau in 1980, Dan's accomplishments directed toward the betterment of public drinking water in this state have been numerous. The number of public water supply systems since primacy has increased from approximately 250 community supplies to 700 and the non-community list (bars, restaurants, campgrounds, etc.) is now at about 1600. Dan has been responsible for implementing the required sampling regulations for this list of more than 2000 supplies (everything from bacteria to radium-226) and he has also made sure that all these systems have been inspected for possible sanitary deficiencies. His emphasis is on correction of system problems and he has done his best to see that his section has cooperated and lent assistance to the individual water supplier to achieve a particular course of corrective action. After all attempts to arrive at a satisfactory solution to a particular problem have been exhausted, enforcement actions for the protection of the public health have been initiated.

Montana had many unfiltered and improperly disinfected surface water supplies in the past. The number of such supplies has been reduced to a very small number with Dan's direction. Most of these systems have installed the necessary treatment processes or developed groundwater. Those which haven't yet made necessary improvements are on compliance schedules and/or health advisories. Enforcement action is pending on a few. Dan has seen to it that each of these systems, which by the way, pose significant health risks, have been evaluated and are in the process of making improvements.

Another area of state responsibility under Dan's management that has been enhanced and greatly improved with his direction is the review of plans and specifications for water system installation, additions and/or modifications. He has devoted a great deal of time and effort toward developing guidelines and standards for this program in order to assure that the consumer gets his or her money's worth with regard to water system operation and maintenance.

Dan's policy has always been to assist and educate the general public and system operators on water system matters. Whenever possible, he has made sure that he or members of his section have attended meetings, seminars, training sessions and one on one visits to give information or lend assistance and just listen to the public. He has always made unbiased decisions that were at many times politically unpopular but were in the best interest of public health. He wholeheartedly believes in what he is doing and gives everything his best efforts. Public drinking water in this state benefits because of it.

Garrity & Kruse Receive Awards

By: Denise Ingman and Dick Pedersen

The Montana Sections of WPCA and AWWA recently presented two highly prestigious awards at the 1987 Annual Conference in Butte.

Mike Garrity, Helena, received the MWPCA Award which is presented to a wastewater plant operator who has demonstrated outstanding performance and professionalism. The recipient must be directly involved with measures that have improved plant efficiency, water quality, and public awareness and advancements in the field of wastewater.

Mike has been working for the City of Helena since August of 1985 as Chief Plant Operator. Mike started his career in the Great Falls water department and transferred to the wastewater department where he worked up to Assistant Superintendent. Mike remained in that capacity when hired by Envirotech after they took over operation of the Great Falls wastewater plant. After periods of time in Petaluma, California and Gresham, Oregon as Wastewater Superintendent for Envirotech, Mike's desire to return to Montana brought him to Helena.

Mike has been instrumental in bringing the Helena plant into consistent compliance with permit conditions. He has implemented a successful computer records keeping system in process control, laboratory data, and preventative maintenance. Weekly process control meetings at the Helena plant directed by Mike bring about a better understanding of wastewater treatment. Mike also carries out training at the plant both in process control and safety.

Mike has contributed to statewide operator improvement by conducting seminars at Northern Montana College in Havre and giving presentations at the Montana Section of AWWA and WPCF Conference in Butte. Mike is also Montana's zone representative for the Professional Wastewater Operators Division of WPCF.

Robert Kruse, Red Lodge, received the AWWA Operator's Meritorious Service Award. This award is to recognize special performance by operators for compliance with public health standards, plant maintenance, development of new ideas, training, and outstanding achievement beyond normal operating responsibilities.

Bob began working for the City of Red Lodge in 1982 and is now the Water Superintendent. He operates the city's direct filtration plant where he consistently produces finished water with an average turbidity of 0.05 NTU. Because Giardia cysts continue to be found in the raw water source and the livelihood and reputation of the city as a tourist community is at risk, a heavy burden is always on him. In addition to optimizing performance at the Red Lodge plant, Bob has willingly shared his knowledge with other operators through participation at training seminars and writing articles for publication. He recently co-authored a paper which was presented in February at a national Giardia conference in Calgary. In addition to his professional interests he is actively involved in his community. In his "spare" time Bob runs a locksmith business.

Congratulations to both Bob and Mike from the Water Quality Bureau and all your fellow professionals!

Midwest Assistance Program

By: Audrey Boe Olsen
Midwest Assistance Program Field Office

County water and sewer districts have a new resource available to them. Midwest Assistance Program, Inc. (MAP) has initiated a program to conduct an environmental, management and leadership development effort with districts across the state of Montana. The purpose of this project is to enable the boards of directors and managers of county water and sewer districts to share expertise and develop helpful management and training programs.

Sixty-seven county water and sewer districts have been identified across the state. An active task force of volunteers from nine districts was established in December 1986 to guide the project over a two year period. Bi-monthly meetings of the task force have been held in January, March, May and July to identify needs and plan activities.

Serving on the task force are directors and/or managers of the following districts: Evergreen County Water and Sewer District of Flathead Co., Homestead Acres Water District of Cascade Co., Power-Teton County Water and Sewer District of Teton Co., Fergus County Water and Sewer District of Fergus Co., Tri-County Water District of Teton Co., Martin City County Water and Sewer District of Flathead Co., Seeley Lake County Water and Sewer District of Missoula Co., Whitefish County Water and Sewer District of Flathead Co., and Sage Creek Water District of Liberty Co.

The task force spearheaded a needs survey of all of the districts early in 1987. The survey requested district history and data as well as needs identification. From the respondents it was learned that the smallest district serves 10 users and the largest has 3000. User fees range from $7.00 per month to $115.00 per month. Some Districts provide water or wastewater only while others provide both water and wastewater service.

After compiling the information obtained from the needs survey, training and workshop activities are being planned and implemented. "How to" booklets/manuals on management and operational aspects of districts as well as a Directory of Services are being put together and will be distributed. On-site technical assistance is also available as part of this project at no cost to the districts.

The first of the regional training sessions is scheduled for Friday, September 11th at Grouse Mountain Lodge in Whitefish, MT. This training session is an intensive one-day workshop for anyone involved in a county water and sewer district. No workshop fee is required to attend and resource material will be provided to participants.

The second of the regional workshops is scheduled for Friday, November 6th at the Quality Inn in Great Falls. Both of these workshops will follow a similar format and are being conducted around the state to allow district board members and managers the opportunity to attend a session in their own area. Other workshops for 1988 have not yet been scheduled. Announcement of the 1988 training schedule will be made available in December.

The Midwest Assistance Program is a private non-profit corporation whose mission is to work with local entities to resolve water and wastewater issues. This MAP project is funded by a grant from the Northwest Area Foundation. For more information contact Judy Piersol, Project Coordinator, MAP Field Office, Box 187, Vale, SD 57788 or call (605) 456-2284 or Audrey Boe Olsen, MAP Field Office, P.O. Box 34, Fortuna, ND 58844 or call (701) 982-3571.

For Sale: The Town of Basin has a Hellige chlorine color comparator with magnifier and two chlorine discs. Never been used. If interested call Al Glasser at 225-3244.

Crone Knoy with Tank Industry Consultants, Inc. of Speedway, Indiana, presented a two day seminar regarding water storage tank design and maintenance on April 30 and May 1, 1987 in Helena. Mr. Knoy has been working in the tank industry for almost 30 years and he presents a very practical approach to water tank maintenance.

I came away from the seminar with a good idea of what to look for in order to evaluate the condition of an existing water storage tank. This information is invaluable to towns and water districts concerned with the development of a maintenance program for water storage reservoirs. It will also allow local governments to adequately develop or review specifications for the coating and/or repair of an existing reservoir.

The following article was written by Mr. Knoy and it outlines some measures that need to be taken when you are considering the painting of a steel reservoir. After reading this article, it should be obvious that there are some things you should consider before hiring an individual or firm to coat the inside or outside of the storage tank. In addition to preparing a set of specifications for the job as outlined in this article, it is required that you make sure the coating is approved for potable water use. This approval information can be obtained by calling the Water Quality Bureau at 444-2406.

Remember that all materials corrode and a scheduled maintenance program for your steel storage tank is an absolute necessity.

Rick Rosa, P.E.
Environmental Engineer
Water Quality Bureau

Maintenance Engineering for Steel Water Storage Tanks

E. Crone Knoy, P.E.
President
TANK INDUSTRY CONSULTANTS, INC.
4912 W. 16th Street
P.O. Box 24359
Speedway, Indiana 46224

A properly designed and executed maintenance program for steel water storage tanks can give them an almost infinite life. A regular pre-maintenance inspection program allows budgets to be established and gives information needed to prepare specifications for the work to be done. Concise, yet complete specifications allow competitive bids to be taken on the work. Qualified inspectors can then enforce these specifications to assure that the quality of workmanship desired is achieved.

In most cases, the maintenance of steel water storage tanks has been an item which was performed at a predetermined time period, or upon the emotionality imparted to the municipal board or utility manager by an itinerant maintenance contractor warning of an imminent failure. The occurrence of "emergency" change orders for repairs many times the price of the initial contract were commonplace. Managers and boards changed, and the cycle started over again. Because many water tanks are high structures, there were few tank owners who had personnel who would climb a tank to check what had to be done and how it was done. Most of those who could climb had neither the experience nor technical background to know what to look for once they got to the top of the tank.

A long-needed professional approach to tank maintenance has been developed and proven to be successful. Several qualified firms have developed throughout the country with the engineering knowledge and practical experience to assist tank owners in maintaining their tanks. They act as engineers, advisors, and inspectors and take care to not enter into the contracting for the actual work operations so that they can give professional opinions without bias.

A recent comparison of the approach to the maintenance of tanks used by four of these firms found that they all had the same three functions:

1. A prebid, pre-maintenance, or preliminary - structural - inspection to determine the needs of the tank(s).

2. The preparation of specifications and bid documents so that all bidders are bidding on the same thing.

3. Inspection of the work as it is being accomplished to assure compliance with the specifications.

It was interesting to note that each organization was geographically remote from the other, had not communicated with each other during the development of their professional

firms, and yet were operating their consulting services in the same three function framework.

A more complete discussion of these functions follows.

Prebid Inspections

The purpose of the prebid inspection is to evaluate the present condition of the tank from the following standpoints:

1. Structural soundness of the tank, its supporting structure, and the foundation.

2. Sanitary condition of the tank interior and the condition of the roof, vent(s), manways, drain, and overflow piping.

3. Condition of ladders, platforms, entry and egress openings, railings and other working or climbing surfaces which affect the safety of workmen, inspectors, or trespassers.

4. Condition of paint or other protective coating, how it is protecting the steel from corrosion, its aesthetic qualities, the remaining life, the percent failure, and its ability to be recoated.

5. Performance of the corrosion (cathodic) protection system as to anode placement, potential readings, and absence of active corrosion.

6. Condition of accessory items such as lighting, level gauges, antennae, etc.

7. Environment and operating conditions which affect the use of the tank (such as freezing conditions), maintenance of the tank (such as proximity of parking lots), or the aggressiveness of the atmosphere and water.

Accomplishing this thorough inspection requires the draining and many times the washing out of the tank to inspect the surfaces and members. The tanks many times require that specialized rigging equipment be used to access the portions requiring inspection. A thorough knowledge of tank construction is a necessity as it is difficult to use a check list at the heights and positions required during the inspection.

Steel plate and structural member thickness should be verified by physical measurement or by ultrasonic thickness measuring equipment. Color photographs should be taken, not only to document to the tank owner the conditions found, but to assist in the preparation of specifications, and to help the prospective bidders analyze the project.

Once the data is obtained, the observations should be analyzed. Prior to making recommendations, it may be necessary to analyze the structural capabilities of the tank and supporting structure based on the steel remaining after corrosion. Millions of pits which were not detrimental to tanks have been welded unnecessarily. Millions more pits which did not exist have also been welded -- either by welding over good steel, or by pretending to weld when no inspector was assigned to the job. There is no set rule on welding or filling pits. Usually scattered pitting presents no structural problem, but leads to leaks. When spot pits reach the point that there is less than one-half the design thickness of the steel remaining, they probably should be welded. When they are less than one-half way through the steel and the edges are sharp or the

cleaning of the pits is not complete, they probably should be filled with a solventless two-component epoxy seam sealer or filler. You will note the word **probably**. The decision as to what to do with pits must be made by looking not only at the present consequences of repairing or not repairing them, but also at what future service life one desires from the tank in question. One might want to repair shallower pits than mentioned above, or it might be decided to repair no pits. General loss of steel thickness, pits very near to each other or vertical groove pitting can cause structural problems, as they affect the membrane strength of the container. In these cases, a structural analysis of the tank steel should be made.

A report certifying the condition of the tank along with recommendations for improvements should be prepared in a manner easily understood by the decision maker(s). The report should include budget estimates for and the life of the recommendations, the remaining life of the tank with and without the accomplishment of the recommendations, and the present day replacement cost of the tank. It is only with this complete information that the board, budget committee, or manager can make decisions concerning the future of the tank.

If the Utility owns more than one tank, the inspection of all of them prior to planning the maintenance work will enable the Utility to spend its money on the tank(s) needing the work first, delaying the work on tanks which is not presently mandatory.

Preparation of Specifications

From the decisions made after the analysis of the report, the scope of the work to be done will be known. The specification writer should have knowledge of the tank condition, the coating systems available, the site and environmental conditions, the repairs required, the capabilities of potential contractors, the American Water Works Association Standard D102, "Painting and Repainting of Steel Tanks for Water Storage", and the Steel Structures Painting Council Volume 2 "Systems and Specifications". If it is anticipated that cathodic protection is required, provisions should be made for accomplishing any cutting or welding prior to cleaning and painting operations. As few "loose ends" as possible should be left; however, many times the exact condition of the steel cannot be determined until it has been abrasive blasted. If the exact quantity of an item is not determinable until the work is in progress, unit prices should be bid based on the quantity anticipated. The specifications should state that unfair, or unbalanced bids for contingent repair work will be cause for rejection of the bid.

The anticipated starting date and the time allowed for completion of the work should take into consideration the following:

1. The anticipated weather conditions.

2. Application characteristics of the materials specified.

3. Work loads of the prospective bidders.

4. Ability of the water system to function without the tank.

5. Normal schedule of activities surrounding the tank site (includes presence of children, automobiles, etc.).

Not only should the specifications contain the technical requirements for the work, they should have requirements for performance and payment bonds, insurance, time for completion, resolution of disputes, and the necessary legal documentation. It should also be provided that an inspection be conducted prior to the expiration of the one year bonded guarantee that is provided by the performance bond.

After receipt of the bids, the contractors and bids should be analyzed as to capabilities and experience, scheduling, and possibly the inspection of previous jobs accomplished.

Inspection of the Work in Process

No matter how carefully the work to be done is planned, how good the specifications, or how good the materials used -- the key to a long lasting paint or repair job is the quality of workmanship. The inspectors assuring this compliance should be capable of accessing all of the work areas and rigging. For the best quality possible, an inspector should be on the project at all times that work is being done. This may cost from 15 to 35 percent of the painting contract, but when one considers that the paint job performed without inspection might last only 10 percent as long as one with qualified full time inspection, the expense of full time inspection can be justified.

Inspection of the work in progress by experienced inspection personnel will offer additional assurance of quality protective coating application. Inspections may be performed on a continuous basis or spot (critical phase) basis. The actual cost of inspection may be less using spot as opposed to full-time resident inspection. However, with spot inspection it is often necessary for work to be redone to comply with the specifications. This somewhat lowers the quality of the finished product, lengthens the job, and is frequently a cause of conflict between the contractor, owner, and inspector. Resident full-time inspection minimizes the amount of "rework" required.

Frequently, the decision is made to have professional inspection on only a "spot" or part time basis. In some cases, personnel of the owner can perform daily inspections in coordination with periodic professional inspection. The frequency of spot inspections required is usually dictated by the dependability of the crew. Inspections are considered necessary at no less than the following times:

1. At the beginning of abrasive blasting to reach an agreement on the degree of cleanliness to be obtained.

2. After the application of portions of the prime coat.

3. Prior to the application of the finish coat.

4. Final inspection to ascertain paint thickness, lack of "holidays", and aesthetic acceptability.

Should repair welding on a unit price basis be required, it should be done only in the

presence of the inspector, so the quantity is verified.

Besides having climbing abilities and practical experience with the application of the coatings and conducting of repairs, the inspector should have a thorough knowledge of the Steel Structures Painting Council and/or National Association of Corrosion Engineers standards and recommendations, the paint manufacturer's recommendations, and the project specifications. The ability to communicate with the crew supervisor, the owner, and the specifying engineer is also a necessity. The inspector should have the knowledge to assist the crew in overcoming problems, instead of just pointing out deficiencies. Each inspection should be documented with a written report of the conditions and findings of each visit.

Items which must be a part of the inspector's equipment are:

1. Visual abrasive blasting standards.

2. Surface profile measuring equipment.

3. A kit for measuring the presence of soluble salts in the abrasive or on the steel.

4. Wet film thickness measurement gauge.

5. Dry film thickness measurement gauge.

6. Certified thickness calibration standards.

7. Steel temperature gauges.

8. Wet bulb and dry bulb temperature measuring equipment and psychrometric tables.

9. Wet sponge holiday detector. (All interior water containing surfaces should be free of holidays or voids in the coating.)

10. "Tooke" Gage (when only spot inspections are made). The Tooke Gage is a destructive gauge which can analyze the system applied from the steel to the top coat of paint.

Coordination of the Three Functions. Experience has shown that the most effective method of carrying out a tank maintenance program is to have the same firm accomplish all three of the maintenance engineering functions. Many times this is not possible within the framework of local politics or existing engineering contracts. If the three functions are not accomplished by the same firm, all involved parties must have a knowledge of the other's duties and must maintain communications at a high professional level.

Can you guess who this new face in the water/wastewater field is? His name is Ross Ingman, son of proud parents Gary and Denise Ingman. Ross was born on May 10, 1987 and weighed 7 lbs. 5 oz. As most of you know, Denise is the Training Officer for the Water Quality Bureau. Congratulations to you both!

Health Department loses a Friend

By: Steven L. Pilcher, Chief
Water Quality Bureau

After a 30-year career with the Department of Health and Environmental Sciences (DHES), most of it spent in water quality management throughout Montana, Don Willems died April 11, 1987, losing a year-long battle with cancer.

Don was born on February 26, 1927 in Minonk, Illinois. He served as a clerk-typist in the U.S. Army in Japan during 1945. He received his B.S. degree in sanitary engineering from the University of Illinois in 1951, then went to work as a Service and Technical Service Engineer for Infilco, Inc. in Tucson, Arizona.

In 1956 he joined the DHES as a public health engineer reviewing plans for sewage and industrial wastewater treatment, performing stream surveys, inspecting municipal water and wastewater facilities and issuing waste discharge permits.

In 1958 he took a leave of absence from the DHES to return to school, and earned a M.S. degree in Civil Engineering from the University of Florida. After receiving his degree, he returned to the DHES as a public health engineer. In 1972 he became the Chief of the Water Quality Bureau, and in 1979, Administrator of the Environmental Sciences Division.

Some of Don's accomplishments during his 30 years with the DHES included: Development of Montana's Surface Water Quality Standards; Establishment of a statewide Water and Wastewater Operator Certification program; State assumption of administrative responsibilities of the Federal Safe Drinking Water Act and the National Pollutant Discharge Elimination System under the Federal Clean Water Act, and representing the DHES and the state on numerous boards and councils, including the Western States Water Council. In addition, Don received the Montana Public Health Association's Twenty-Five Years of Service Award in 1982, the MWPCA's Arthur Sidney Bedell Award in 1973 and the AWWA's George W. Fuller Award in 1973. He also published an article in the Journal of American Water Works Association, "Electrophoretic Studies of Coagulation for Removal of Organic Color" with A.P. Black in the May 1961 issue.

One part of his job that he enjoyed most was working with water and wastewater operators around the state and he was on a first name basis with most. He developed several close friendships with operators and others in the water and wastewater field and will be missed by many.

Outside of the office, Don enjoyed golf, tennis and poker, as well as Helena's annual jazz festival. He was a long-time member of the Plymouth Congregational Church where he served on the Finance Committee. He is survived by his wife, Vona, a daughter, two sons and a grandson.

In his years at the DHES, Don was quiet, but supportive, and always calm under the pressures and conflicts he faced. He was always willing to find ways to work things out. He recognized people's abilities and was ready to give them a chance. People worked with Don, rather than for him.

Donald G. Willems Scholarship

During the 62nd annual meeting of the Montana Section of the American Water Works Association (MSAWWA) and the 43rd annual meeting of the Montana Water Pollution Control Association (MWPCA), the members voted unanimously to name their annual scholarship(s) the MSAWWA/MWPCA Donald G. Willems Scholarship. The members of the associations offer this recognition for Don Willems in return for his outstanding personal and professional contributions in the fields of water treatment and water pollution control. In addition, the contributions Mr. Willems made toward the education of innumerable individuals and his support of Montana's colleges and universities makes this recognition very appropriate.

The scholarship(s) shall be awarded annually to an applicant(s) that is currently enrolled in a Montana college or university and has completed at least one academic year successfully. The applicants' major must aim him/her for employment in the fields of water treatment and/or water pollution control (i.e. treatment, engineering, operator training, or laboratory). The scholarship(s) shall be $250 to $500. The awarding of the scholarship(s) shall be during the annual meeting of the two associations in March of each year.

The fund presently has in excess of $8,990 that will be utilized to finance the scholarship(s). Contributions to this fund by associations and private individuals shall be continued indefinitely. In excess of $888 of contributions have been received from private individuals and businesses since Mr. Willems death on April 11, 1987. Contributions to the fund can be sent to the MSAWWA/MWPCA Scholarship Fund, c/o American Federal Savings and Loan, 347 N. Last Chance Gulch, Helena, MT 59601.

It is with great respect for Mr. Willems' accomplishments and untiring efforts over the last thirty plus years that the associations offer this recognition.

Professional Development of Water & Wastewater Operators

By: Leonard Willett, Chief Water Plant Operator
Missouri River Water Treatment Plant, Helena, Montana

In 1984, the city of Helena water and wastewater departments developed a set of guidelines for advancing and promoting plant operators. There had been no set guidelines for being promoted up to this time and operators who had been with the city for three years were at the same grade as operators with ten or more years experience. The supervisors and the plant operators wanted some way of recognizing the more experienced operator and providing more responsibility if the operator desired along with increasing promotional opportunities.

It was the goal of the water and wastewater departments to set up firm written guidelines that would increase responsibilities, promotions, and operator pay status. These guidelines would be consistant in both departments and would treat all operators equally. They would also provide the operators with the criteria necessary to be considered for promotion.

To develop these guidelines, numerous meetings were set up with all water and wastewater operating personnel and they were asked what distinguishes an operator with many years of experience from less experienced operators. A written policy came out of these meetings titled,"The Hiring and Advancement Policy Guidelines for Water and Wastewater Operators". This policy, although difficult to develop, provides the operators with an opportunity for professional development in their chosen field. The city of Helena benefited by having better trained operators and operators more satisfied with their jobs. This in turn provided a better quality of water to consumers and a more polished finish to the wastewater plant's discharge.

The following is the hiring and advancement policy. As you will see, this document outlines what is expected of newly hired operators without experience and operators with numerous years of experience. Keep in mind that such a policy would need to be developed to fit each community's water and wastewater system needs but these guidelines could be used as a rough outline.

PLANT OPERATOR HIRING AND ADVANCEMENT POLICY - CITY OF HELENA PUBLIC WORKS DEPARTMENT - ADOPTED BY CITY COMMISSION MAY 13, 1985

General: When referencing a certificate, it must be in the field pertaining to the position/department.

Grade 13: Plant Operator In-Training - Starting pay scale: $1190 per month. New plant operator with no certificate. The operator must pass the Class I Operators Certification examination for the State of Montana within three (3) testing attempts during the first twenty-four (24) months of employment in order to continue in this position with the City of Helena. Step increases shall be in accordance with Section 10-8 of the City of Helena Personnel Manual.

Grade 14: Certified Plant Operator In-Training - Starting pay scale: $1249 per month. Plant Operator In-Training may be eligible for Grade 14 upon successfully passing the Class I Operators Certification examination and upon a satisfactory performance evaluation. Probation period and step will not be affected. Salary increase will be retroactive to date on the Class I Operator In-Training certificate. A new employee hired in a plant operator position would qualify as a Certified Plant Operator In-Training if he/she possesses a State of Montana Class I Plant Operator In-Training certificate.

Grade 16: Certified Plant Operator I - Starting pay scale: $1377 per month. Certified Plant Operator In-Training may be eligible for Grade 16 upon receiving his/her Class I Operators certificate from the State of Montana and upon a satisfactory performance evaluation. Probation period and step will not be affected. Salary increase will be retroactive to the date that requirements for the State of Montana Class I Certified Operators certificate are met. A new employee hired in a plant operator position would qualify as a Certified Plant Operator I if he/she possesses a State of Montana Class I Certified Plant Operators certificate.

Grade 17: Certified Plant Operator II - Starting pay scale: $1673 per month. Operator may be eligible for Grade 17 after two (2) consecutive years at Grade 16, Certified Plant Operator I, with the City of Helena and upon a satisfactory performance evaluation provided the following requirements are met:

- Must have complete knowledge of the operations of the plant
- Must be able to instruct and train all subordinate operators on proper plant operation and preventive maintenance
- Must participate in the preparation of technical or operational reports recommending improved plant efficiency or cost reduction measures
- Must have complete knowledge of the City of Helena algae problem and be able to count and identify known problem algae (Water Department only)
- Must have attended while at Grade 16 forty (40) hours of outside training in the water/wastewater field through workshops, one-day seminars, correspondence courses, annual water/wastewater school, etc.
- Must become specialized in at least one of the major processes or operations of the plant
- Must be a member or affiliate member of a job-related professional organization

Grade 18: Certified Plant Operator III - Starting pay scale: $1829 per month. Operator may be eligible for Grade 18 after two (2) consecutive years at Grade 17, Certified Plant Operator II, with the City of Helena and upon a satisfactory performance evaluation provided the following requirements are met:

- Must be able to operate and maintain all the water production facilities or operate all the processes in the wastewater facility
- Must be able to instruct and train all operators on all plant operations, preventive maintenance, reports, etc.
- Must have sixteen (16) hours of supervisory training
- Must have attended while at Grade 17 forty (40) hours of outside training in water/wastewater field
- Must write a technical report of not less than 1,000 words on any one phase of the plant operation and present it to the water/wastewater staff, or a civic or professional group
- Must satisfactorily complete a written examination, administered by the department, that will cover the complete plant operation
- Must understand and participate in the preparation and/or administering of the annual budget
- Must be a member or affiliate member of a job-related professional organization

I feel it is important to mention that these guidelines were developed by water and wastewater operators and presented to management for approval. They were adopted in May of 1985. The water plant currently has one (1) certified plant operator III, one (1) certified plant operator II, two (2) certified plant operator I, and two (2) certified plant operators in-training.

The greatest asset of any organization is the people working within the organization. This is one step the city of Helena has taken to recognize their operators as professional individuals, along with providing them the opportunity to advance in their careers. This policy will help to provide educational opportunities in their chosen field, membership and involvement in job related professional organizations (AWWA & MPCF), and provide higher pay status for added responsibilities and increased experience. The city's benefit can be summed up in a very short sentence. The employees make the organization what it is.

"All For One"

AWWA Membership Campaign

The National American Water Works Association has started a new "All For One" membership campaign. This campaign is striving to recruit new members and retain our current ones. We've got a lot of momentum going and we need to keep it up to show our strength as THE association for water supply professionals. The Montana Section of AWWA has pledged to support the campaign and is offering some incentives to keep the drive alive. So, tell some one to "**TRY US**"!

Hats Off To New Members !!
We'll send an AWWA baseball cap to new members that use the membership form in this Big Sky Clearwater.

Mug a Recruiter !!
We'll send an AWWA mug to recruiters that use this membership form to sponsor a new member.

Free Dues !!
All recruiters that sponser a new member, using any AWWA application, between June 1, 1987 and January 1, 1988 will be placed in a drawing for FREE Dues. These dues are limited to a $53.00 value and can be ONE YEAR OF ACTIVE MEMBERSHIP OR TWO YEARS OF AFFILIATE MEMBERSHIP!

We've also got a special surprise for the top recruiter who signs up the most new members between June 1, 1987 and January 1, 1988.

Both the drawing and the Top Recruiter Surprise will be awarded at the 1988 MSAWWA/WPCA meetings March 16-18 in Helena.

For more information or membership applications, please contact:

Donna Howell
Cogswell Building, A206
Helena, MT 59620
444-2406

or

Clint Tinsley
414 E. Callender
Livingston, MT 59047
222-1142

Join Now and Grow With Us

INDIVIDUAL

AMERICAN WATER WORKS ASSOCIATION MEMBERSHIP APPLICATION

Complete this form and mail to:
AWWA / 6666 W. Quincy Avenue / Denver, CO 80235 / (303) 794-7711

BSCWS

AWWA USE ONLY

PLEASE PRINT OR TYPE

LAST NAME _____ FIRST NAME and middle initial _____

MAILING ADDRESS _____

CITY _____ STATE OR PROVINCE _____ ZIP CODE _____

AREA CODE _____ TELEPHONE _____

TITLE _____

EMPLOYER'S NAME if not already in mailing address _____

APPLICANT'S SIGNATURE _____ DATE _____

SIGNATURE OF AWWA MEMBER ENDORSING APPLICATION (Optional) _____ ENDORSER MEMBER NUMBER _____

ANNUAL DUES $_____

NEG Assessment* _____

Multi-Section Option (other than own) _____

Total Due $_____

Check One	Grade Code	Annual Dues
☐ Active	02	$53.00
☐ Affiliate (Strictly for operator-level personnel or employees of small utilities)	06	24.00
☐ Student (Must be enrolled and carrying at least 10 credit hours)	14	15.00

*Applicants with an address in the New England Section (ME, NH, RI, VT, MA) are required to include an assessment of $26.50 with their AWWA dues.
Multi-section membership on reverse side.

Make check payable to AWWA (Canadian funds add 15%)

☐ American Express ☐ Diner's Club ☐ MasterCard ☐ Visa

Credit Card No. _____

Exp. Date _____

☐ Send invoice

If you have been a member of AWWA before, indicate dates here:

_____

ALL APPLICANTS SHOULD COMPLETE THIS SECTION:

Circle the descriptions below that best describe you. The information is used in audits of AWWA readership.
Circle only ONE in each group.

1. BUSINESS AND INDUSTRY
A. Public Water Supply Utility – Municipally Owned
B. Public Water Supply Utility – Investor Owned
C. Governmental – Federal, State, Local
D. Consultant
E. Contractor
F. Private Industrial Systems or Water Wholesaler
G. Manufacturer of Equipment & Supplies Including Representatives
H. Distributors of Equipment & Supplies Including Representatives
I. Educational Institutions, Faculty and Students, Libraries, and Other Related Organizations
J. Fully Retired
K. Research Labs

2. JOB TITLE
A. Executive – Gen'l Mgr., Commissioner, Board Member, City Mgr., Mayor, President, Vice-President, Owner, Partner, Director, etc.
B. Management – Division Head, Section Head, Mgr., Chief Engineer, Comptroller, etc.
C. Engineering/non-managerial – Civil Engr., Mech. Engr., Envir. Engr., Planning Mgr., Field Engr., Systems Designer, etc.
D. Scientific/non-managerial – Chemist, Biologist, Biophysicist, Researcher, Analyst, etc.
E. Purchasing – Purchasing Agent, Procurement Specialist, Buyer, etc.
F. Operations – Foreman, Operator, Maintenance, Crewman, Service Rep., etc.
G. Marketing & Sales/non-managerial – Mkt. Analyst, Mkt. Rep., Salesman, Sales Rep., etc.
H. Other (describe) _____

_____

CHECK FIELD(S) SERVED:
5 ☐ Water Supply Only
7 ☐ Wastewater Only
9 ☐ Both
3 ☐ Other

In some AWWA sections, a portion of the section allotment equal to 50 percent or more of the domestic subscription rate charged for the section periodical will be allocated toward a subscription of that periodical.

Dues allocated for each publication members receive:
Journal $25
Mainstream $6
OpFlow $5
Waterworld News $5

MWPCA

Membership Information

The Montana Water Pollution Control Association (MWPCA) is one of 67 associations which comprise the Water Pollution Control Federation (WPCF).

Membership in WPCF brings with it a great number of benefits. Most visible among these is a subscription to the Journal Water Pollution Control Federation and the Federation's newsletter, Highlights or Operations Forum, depending upon membership type. But there are many other advantages to joining WPCF. Members receive substantial discounts on most WPCF publications and conference registration. They are eligible to serve on WPCF committees and task groups, and receive first-hand the benefits of technological breakthroughs in the field. The five categories of membership in the WPCF/MWPCA are:

1. Active/General Members: The members of this group make up the largest category of the WPCF membership. They are people involved in many different aspects of wastewater treatment and include municipal officials, superintendents and operators of pollution control facilities, professional engineers, chemists, bacteriologists, biologists, researchers, teachers, and state and federal pollution control officials. In addition to the $50 per year Federation dues, the Montana member association dues are $5 per year. Active members receive the WPCF Journal and the newsletter Highlights.

2. Professional Wastewater Operations Division Members: Individuals involved in the daily on-site operation and maintenance of treatment plants, collection systems, or laboratories are eligible for membership in the PWOD. Members receive Operations Forum, WPCF's magazine for wastewater professionals. Dues for qualified operators are $17.50 annually, plus Montana member association dues of $5 per year. An add-on subscription to the Journal and Highlights is also available.

3. Student Members: Student members are active members of the WPCF who are currently enrolled as regular students in a college or university and who spend at least one-half of their time on academic course work, or its equivalent. Dues to the Federation are $17.50 per year. In addition there are member association dues of $2 per year. Student members receive the WPCF Journal and the newsletter Highlights.

4. Corporate Members: This membership category includes public or private corporations (in part or in whole), governmental boards, districts or commissions, or other corporate bodies and organizations. In addition to the $175 per year Federation dues, corporate members are also responsible for the member association's dues of $5 per year. Corporate members receive the WPCF Journal, Operations Forum and the newsletter Highlights.

5. Dual Member: This membership category allows members of other WPCF Associations who do business with, or are involved with, the Montana Water Pollution control industry to join the MWPCA. This allows out-of-state water pollution control professionals to further their contacts with the Montana water pollution control community. Membership dues are $5 per year. Dual members receive the MWPCA newsletter Big Sky Clearwater.

Membership Application

Water Pollution Control Federation

601 Wythe Street
Alexandria, Virginia 22314-1994

Association

Montana Water Pollution Control Association

Use this application to join the Water Pollution Control Federation and your local Member Association. Simply complete this application and return it to the address below. Along with your monthly publications, you are also entitled to group insurance, technical assistance, discount on technical publications, and much more!

Please print.

First Name, Middle Initial (11) | Last Name (16) | (Jr., Sr., etc.) (3)

Mailing address ☐ Business or ☐ Home

Business Name (if applicable) (30)

Street or P.O. Box (30)

City (20) | State (2) | Zip Code (9)

Area Code—Telephone (10) | Country (If Outside U.S.) (16)

WPCF Sponsor (Not Required) (28) | Sponsor's Member I.D. Number (6)

Employer Code (2)

11 - Local/Regional Government/Agency
13 - State/Interstate Government/Agency
16 - Federal Government/Agency
21 - Consulting Firm (Engineering/Other)
25 - Wastewater Equipment/Material/Supplier
27 - Industry
28 - Construction Contractor
31 - Educational Institution
61 - Other (Please specify): _____

Education Code (1)

1 - Less than High School
2 - Training Courses, Short School
3 - High School
4 - Attended College
5 - Completed Junior College
6 - Bachelor's Degree
7 - Advanced Degree

Membership Categories

☐ **Active**	☐ **Operations Division**	☐ **Student**	☐ **Corporate**
For individuals involved or interested in the advancement of knowledge pertaining to water quality.	For individuals working on a day-to-day basis (or retired from) in a wastewater collection, treatment, or laboratory facility.	For individuals enrolled at least half-time in a college or university.	For companies engaged in the design, construction, operation or management of water quality systems.
Dues $55.00	Dues $22.50	Dues $19.50	Dues $180.00
Journal Included	*Journal* ☐ $30.00	*Journal* Included	*Journal* Included
Highlights Included	*Highlights* ☐ $15.00	*Highlights* Included	*Highlights* Included
Forum ☐ $12.50	*Forum* Included	*Forum* ☐ $12.50	*Forum* Included
TOTAL $_____	TOTAL $_____	TOTAL $_____	TOTAL $_____

Method of Payment

☐ Check Enclosed—Make check payable to WPCF.
☐ Charge my ☐ VISA ☐ MasterCard ☐ American Express

Account Number Exp. Date

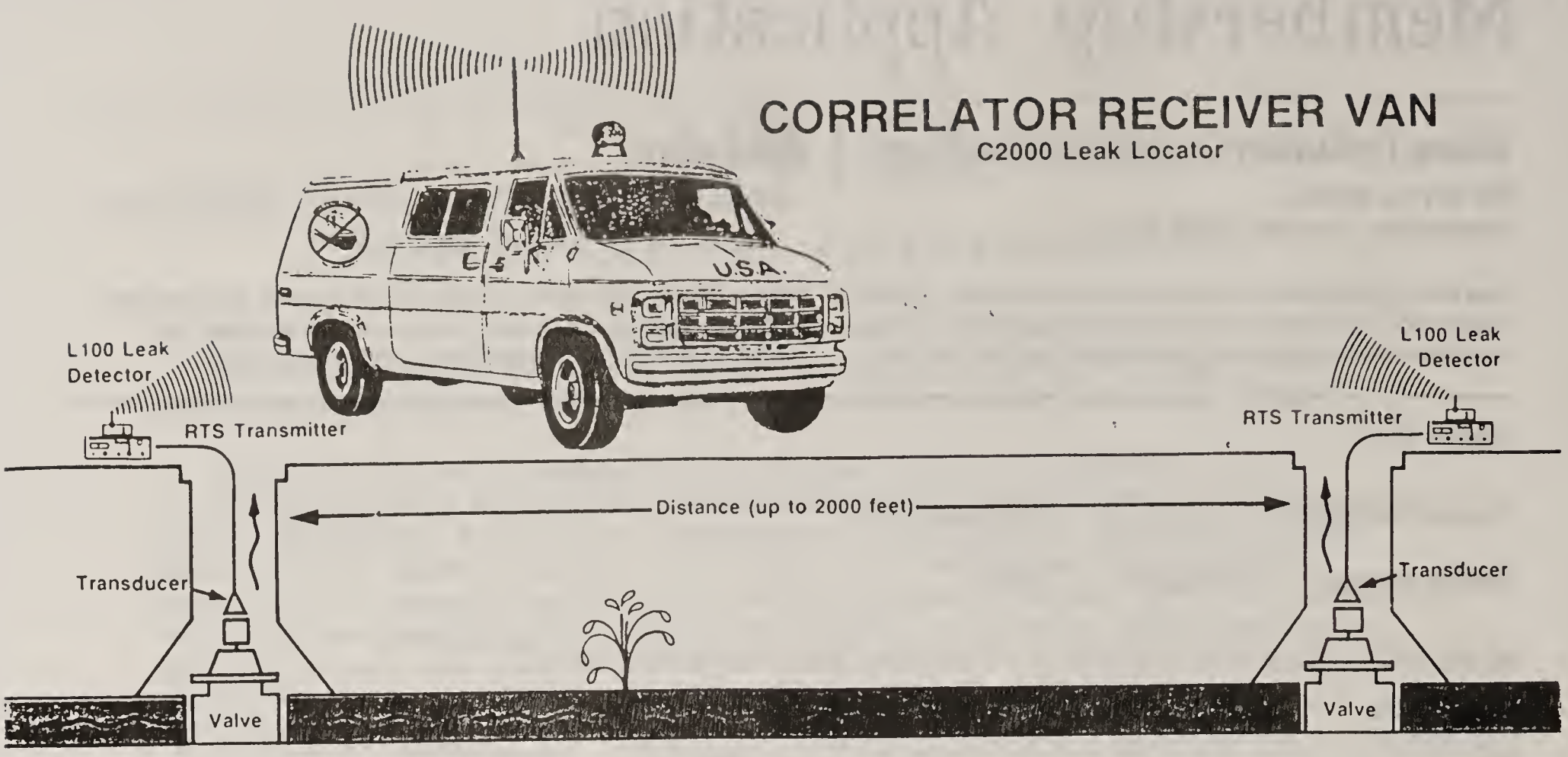
( )
Signature Daytime Phone No.

Send Completed Application and Payment to:

WPCF, Member Records
601 Wythe Street
Alexandria, Virginia 22314-1994

For more information, call (703) 684-2452

Postal Requirement: Dues allocated for publications when included in membership: *JWPCF* — $15; *Highlights* — $3; *Operations Forum* — $5.



LEAKS CREATE SOUND WAVES:

Technology Conserves Resources

By: Harvey Wicklund, President
Utility Service Associates, Inc.

Technology has finally taken the guess work out of water leak location.

The detection of water loss due to leakage for many water utilities is the single most time consuming and costly problem encountered. However, a cost effective approach to this problem is now available in Montana. This method uses electronic sonic leak detection instruments for surveying water lines and a microprocessor based leak correlator computer for pinpointing leaks.

How does it work?

A fracture or opening in a water pipe allows the loss of pressurized fluid. This escaping fluid creates sound frequencies which travel in the pipe and this can be monitored at various locations along the main. During investigation of known or suspected leaks, the operator evaluates a segment of pipe by directly contacting appurtenances (valves, hydrants, etc.) on the pipe with the leak listening device. Electronic amplification of the acoustical signal picked up by this listening device enables the operator to listen to (or sound) the pipe for leaks.

A leak detection survey is established by applying the above procedure throughout the distribution system. An area can be evaluated for leakage by systematically sounding the pipe at available appurtenances on a block by block basis. Normally, an effective survey can be conducted by listening to line valves available at most block intersections. Where line valves are not available, hydrants, hydrant valves, services, curb stops and other available listening points can be substituted.

In both the investigation of known leaks and the performance of surveys, the leak listening device is ultimately used to establish leak sounds at two available access points in the vicinity of a given leak. The two access points are then used during the leak pinpointing phase with the correlator computer. The leak listening device serves as an audio sensor input unit to the correlator computer which identifies the exact location of the leak.

What does a survey involve?

The first step in any survey is a review of the distribution map of the system for familiarization of the pipe network and available appurtenances (access points). Physical contact is made with the system (valves, fire hydrants, curb stops) at intervals no greater than 400 feet, if contact points are available and accessible. This allows for even very quiet leaks to be located. When normal contact points are not available within a reasonable distance, an on ground surface listening device may be used for surveying.

All indications of a leak are verified a second time, after which the leak is located with a computer designed to pinpoint leak locations without drill holes or excavations. The leak site information is entered into the correlator computer (pipe size and type, and measured distance of pipe between listening stations) and the leak position is displayed on a video graph. The distance to the leak is measured off on the ground surface and the location is marked. The area can then be excavated and the leak repaired. Although the correlator computer can identify multiple leaks under many conditions, re-sounding of the area is recommended to ensure no further leakage exists.

Valves and hydrants should not normally require operation during surveying and pinpointing. However, some services may be shut off to eliminate excessive noises and help determine service line leaks.

The correlation equipment has the capability to prompt the operator for input of the variables when different pipe sizes and/or pipe materials are encountered in the same span to be investigated. This is necessary to ensure accuracy of the results based on the automatic computation of the correct leak sound velocity. Up to four various pipe sizes and types can be correlated on at one time in a given span.

A detailed report of sounding locations, leaks that have been pinpointed, and observations as to other problem areas which may be discovered during the survey will be supplied daily. A final report is furnished of all operations and results of the completed survey, including a sketch showing the location of each leak located. Whenever the utility repairs any leak detected by the service company prior to completion of the field work, the service company resurveys that section of the system, to be sure no quiet leaks were missed due to an over powering noisy leak sound.

What is the utility required to provide?

The service company furnishes a field technician, instruments, equipment and tools to complete the survey.

To expedite the survey, the utility will supply a helper who has general information of the system and can assist the field technician and provide traffic control. Line maps of the area to be surveyed must be provided. Valves and service stops will need to be located and must be accessible by hand, curb box key or probe.

Intentional Contamination

Martin City Water Supply Contamination is due to Vandalism!

By: Rick Rosa
Water Quality Bureau

Unsatisfactory bacteriological samples from the Martin City water supply submitted during the second and third weeks of June caused some alarm amongst the water district board members. There had not been any unsatisfactory samples submitted since the new water system was put on line approximately one year ago.

The initial blame was placed on the new well. Perhaps one of the drainfields in the area was contaminating the supply. The distribution system was also suspected. Perhaps a leak in one of the mains was allowing the entry of contamination.

The investigation into the problem continued until the interior of the water storage reservoir was looked at. The access hatch on the reservoir was opened to find human feces floating on the surface of the water.

A boil water order was immediately initiated. The water tank was drained and cleaned out and the entire distribution system was thoroughly disinfected. The contamination has been eliminated and corrective action has been taken to see that this problem does not occur in the future.

The water storage reservoir was not locked. The reason for it not being locked was that the access hatch did not allow for a padlock to be placed on it. The hatch has since been modified and the tank is secure.

I think we can all gain by this experience. I know from my inspection of public water supply systems that the facilities are not always locked. Take a few minutes as soon as possible to check out your system. Please see that all water storage reservoirs and other water supply facilities are properly secured to prevent intentional contamination.

As far as I know, there hasn't been any sickness reported that can be attributed to the Martin City incident. The next water system may not be that lucky.

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Developing a Cross-Connection Control Ordinance

(Portions Reprinted from Backflow Prevention Magazine - August 1985)

One of the first steps involved in establishing a comprehensive cross-connection control program is to adopt an ordinance which makes cross connections illegal and provides for enforcement action, installation requirements and compliance procedures. Drafting a good ordinance that includes all the necessary information and closes all the loopholes can be difficult. Unfortunately, many ordinances are adopted before the entire program has been carefully thought through, and the ordinance itself becomes a stumbling block to protecting the water supply. Before you start writing your ordinance, consider these questions carefully.

1. Will the ordinance cover only containment (devices installed at the service connection to protect the water supply) or will it cover cross connections in internal plumbing systems as well?

Most cities concern themselves with containment only. Should your community desire to extend its cross connection control program to internal plumbing, the ordinance will have to cover building inspections, internal hazards, etc.

2. What is the basis of your authority for establishing a cross connection control program?

When there is an existing state regulation or rule relating to cross connections, you can probably assume you have the authority to establish a program. The State of Montana has such an administrative rule. (Please contact the Water Quality Bureau if you would like a copy of this rule.) If your ordinance will address internal plumbing systems, the Occupational Safety and Health Administration (OSHA) regulations address cross connections in places of employment. All of the major plumbing codes contain sections on cross connections as well.

3. How are you going to pay for the cost of implementing the program?

Various communities have used different approaches to financing the cost of a cross-connection control program -- from rate increases to user fees and increased revenue from establishing a metered system. It is important to remember that the cost of the program will probably be considerably less than the cost of even one cross connection accident that causes injury or damage.

4. Who will own the devices installed for containment purposes -- the city or the customer?

There are advantages and disadvantages to both approaches. Consider liability issues, insurance, and manpower requirements when making this determination.

5. Who will test and maintain the devices -- the city or private contractors hired by the customer?

Again, there are some real benefits and drawbacks to both options. Try to envision how your program will operate a year after it is established -- tests that need to be performed, repairs that need to be made, etc. Consider liability issues and quality control when making this determination.

6. What types of devices and installations will be acceptable? Does the city have access to the USC Foundation list of approved devices? Do installation criteria need to be adopted? Would it be beneficial to require plumbers and contractors to obtain training for the installation of devices?

This area needs careful consideration and must be covered in detail in a comprehensive ordinance. For example, if you determine that the city will accept only double check valve assemblies and reduced pressure principle devices for containment purposes, but you want the ordinance to cover sprinkler systems too, you might have to write an exception for pressure vacuum breakers into the ordinance. The city may want to require contractors who will be installing devices to receive special training to establish quality control on installations.

7. Who will be responsible for which parts of the program?

The water supplier is generally responsible for overseeing a containment program. However, if you plan to address internal cross connections in the ordinance, you may need to coordinate your efforts with the plumbing and building departments. Personnel who may become involved in the program, are the water manager, the distribution superintendent, the water treatment superintendent, meter shop foreman, quality control specialist, public information officer, building inspector, plumbing inspector, health department officials, city engineers, etc.

8. What type of compliance procedures will be needed to enforce the ordinance? What type of penalty will be imposed for noncompliance? Will a hearing process need to be established? Does the city already have the authority to terminate water service in the event extreme measures must be taken?

Generally, compliance procedures and penalties should be in keeping with other city ordinances. Some cities impose fines for noncompliance. Penalties should exceed the cost of compliance. You must determine whether or not to establish a hearing procedure, and to what extent the city is willing to work with the customer to achieve compliance. If devices are customer-owned, for example, but the customer cannot afford to install and maintain the device, can the city make the installation and bill the customer over a period of time with his regular water bill? While termination of service is not generally practiced, it is a powerful enforcement incentive, and should be provided for in the ordinance. If the city owns and maintains all devices for containment purposes, compliance is not a problem. However, the ordinance should still address penalties for tampering with, bypassing, and removing devices.

9. Will the proposed ordinance conflict with other established ordinances or codes?

For example, if your city has adopted a plumbing code, will the provisions of the ordinance contradict the provisions of the plumbing code? It may be necessary to amend existing codes that have been previously adopted to eliminate confusion and close loopholes.

How much does it cost a city to implement a cross-connection control program?

The cost of implementing a comprehensive program will depend on how you intend to handle the program. Some of the costs involved will include:

* Manpower -- Someone will have to administer the program. Generally, a person on the existing staff is designated to administer the program.

* Devices -- Every city owns and/or operates facilities that will be found to have cross connections. Depending on the size of the city, the cost of devices and installations can be substantial. However, it is extremely important, from a public relations point of view, that the city take the first step by inspecting its own facilities and correcting cross connections that are located there. Keep in mind, however, that the cost of purchasing and installing devices will probably be considerably less than the cost of a single cross connection accident.

* Public information -- Public information is an important part of a comprehensive program. The city must enlist the help of its consumers to locate and correct residential and commercial cross connections. Before consumers can offer reliable assistance, however, they must be educated about cross connection hazards and understand why the program is being established. Public information will also help reduce resistance to the consumer's cost of purchasing and installing devices.

* Forms and recordkeeping -- Special forms for tests and inspections will probably be needed, as will a system for keeping records of installed devices, tests, and maintenance activities. Small computers are ideally suited to this type of data storage/retrieval system.

Once you have determined exactly how your program will be administered, you can write an ordinance that will assist you in implementing it. While some communities have adopted ordinances that simply make cross-connections illegal, a detailed ordinance that spells out the entire program has some distinct advantages. While it is true that a simple ordinance banning cross connections allows more flexibility in changing the program as it develops, it is more difficult to enforce, may be open to a variety of interpretations, and the intent of the ordinance may be altered over a period of time. A detailed ordinance that addresses all aspects of the program is much easier to enforce uniformly, it will not be misinterpreted, and it will not accommodate as many loopholes. The primary objection to adopting a detailed ordinance is that should the city's needs change in the future, the ordinance will have to be amended. However, the more formal the program, the more likely it is to be sustained over a long period of time, which is definitely an advantage. A comprehensive ordinance will generally cover

* Definitions of cross connection terminology.
* Authority to establish and enforce a cross connection control program.
* Inspection and testing procedures, policy statements, and compliance procedures.
* Descriptions of approved devices, degree of hazard, type of device required, and installation criteria.
* Special requirements for irrigation systems and fire systems.
* Provisions for existing cross connections with unapproved devices.
* Violations and penalties.

Be sure the council is well-informed and understands the concepts of the program in advance of calling for a vote on the proposed ordinance. It is a good idea to prepare a fiscal impact statement of the potential investment and insurance costs. Above all, consult your attorney before adopting an ordinance of this type.

Regardless of how extensive your program will be or how you plan to administer it, the effort required to develop an ordinance that will meet the city's needs is well worthwhile. You may even want to hire a private consultant to assist in drafting the ordinance and establishing your program. Protecting the health of consumers, the city's water supply system, and the reputation of the business community is a wise investment for any city to make.

Revised 1987 Training Calendar

Following is a list of training events for water and wastewater operators for the remainder of 1987. The sponsors of each seminar will send specific agendas approximately 2 to 4 weeks in advance to operators in the surrounding area or to everyone when a seminar is offered in one location only. Additional seminars may be scheduled and advertised in addition. If you need information prior to receiving a specific agenda, call Denise Ingman or Dick Pedersen at the Water Quality Bureau in Helena at 444-2406.

DATE	TOPIC & APPROX. COST	LOCATION	ESTIMATED CEC'S
Aug. 5	Chlorination, $10	Billings	.5
Aug. 6	Chlorination, $10	Glendive	.5
Aug. 12	Rate Structuring & Well Repairs	Bozeman	.5
Aug. 18	Pump Seals & Packings & Alignment, $10	Helena	.5

Sept. 1	Chlorination	Wolf Point	.5
Sept. 3	Chlorination	Lewistown	.5
Sept. 4	Lagoons & System Math	Lewistown	.5
Sept. 14-18	Annual Operators School and Certification Exam, $50	Bozeman	2.5
Oct. 7-8-9	Montana Rural Water Annual Conference, $35	Great Falls	.75
Oct. 18-24	National Rural Water Annual Conference	Charleston, S.C	1.0
Oct. 20	Pump Seals & Packings & Alignment, $10	Missoula	.5
Oct. 22	Pump Seals & Packings & Alignment, $10	Kalispell	.5
Dec. 3	Basic Topics for Small Water Systems	Thompson Falls	.5

The Federal Government Says:

"Get the Lead Out" (Of Drinking Water)

By: Bill Engle
Environmental Protection Agency

Lead is a toxic metal which has been widely used in numerous products. In the last few years, controls or restrictions have been placed on the amount of lead that is allowed to be in gasoline, food containers and paint. These controls have resulted in very significant reductions in human exposure to lead. Now the list of controlled substances is being expanded to include drinking water.

On June 19, 1986, President Reagan signed into law the Amendments to the Safe Drinking Water Act. A new Section (1417 of the Act) addresses the long-standing public health concern about lead in drinking water. This section requires that:

1. Effective June 19, 1986, the use of lead solder or flux exceeding 0.2 percent lead content is prohibited for use in the installation and repair of public water systems and interior plumbing systems serving residences and buildings connected to such systems. The lead content of pipes in or connected to such systems may not exceed 8 percent.

2. Beginning June 19, 1988, public water systems are required to notify customers of possible lead contamination and the potential adverse health effects of lead. Water systems that will be required to notify their customers are those that have lead pipes in their distribution systems and/or those where the corrosivity of the water supply is sufficient to cause leaching of lead.

3. Beginning June 19, 1988, the U. S. Department of Health and Urban Development and the Veterans Administration may not provide mortgage insurance or other assistance to new residential property if plumbing contains lead in excess of 0.2 percent in solder or flux, and 8 percent in pipe or pipe fittings.

4. Beginning June 19, 1988, solder which has a lead content in excess of 0.2 percent must prominently display a warning label saying that its use in any private or public drinking water system is prohibited.

Lead rarely occurs naturally in drinking water sources. Presently, the maximum contaminant level for lead is 50 parts per billion. EPA is proposing that this maximum level be reduced to 20 parts per billion. This will not affect any public water systems in Montana since past water analyses indicate that the highest lead level in any water source in Montana is 10 parts per billion.

Typically, lead gets into the water after it leaves its original source. This happens as it passes through the pipes that deliver water to the consumer's faucet. If lead pipes have been used in the distribution system, lead can "leach" into the water. Leaching is just another way of saying that soluble lead, once part of the plumbing material, has corroded and become dissolved in the water.

Generally, however, the greatest potential for lead getting into water is from solder and/or flux. Lead leaching from solder joints is attributed to galvanic corrosion. This type of corrosion occurs when two different metals, such as copper and lead, come into contact with each other. Homes that have copper pipes joined with lead solder are vulnerable to galvanic corrosion.

Flux (a substance used in the soldering process to clean the surfaces being joined) can also increase the susceptibility of lead to galvanic corrosion. Since flux often contains large amounts of lead, it can also be a source of contamination.

By eliminating the use of lead solders, fluxes and piping, future drinking water contamination by lead should be alleviated. However, what's to be done about current lead-contaminated drinking water? Most of the problem seems to occur in houses that are either very old or very new. Up through the early 1900's, it was common practice to use lead pipes in distribution systems and household plumbing. Since about 1930, copper pipes have been used extensively in residential plumbing, and most copper piping is joined together through the use of lead solders. Lead contamination from these solders decreases as a house gets older. This is because mineral deposits from the water tend to coat the inside of the pipe and stop the water from corroding away any more of the lead solder. After about 5 years, lead contamination from household plumbing seems to disappear.

You can find out if your water supply has corrosive tendencies by contacting the Water Quality Bureau in Helena. If the supply is corrosive, you may be having lead contamination problems in your community. If so, you will want to notify your consumers and advise them of the measures that can be taken to decrease lead contamination in their home. You can tell them it is a good idea to flush out the plumbing every morning by letting the water run for about five minutes before using and it is also a good idea not to consume water from the hot water tap. If you do have corrosive water, you may want to start thinking about corrosion control treatment for the water system.

EPA has published a booklet entitled "Lead and Your Drinking Water". This booklet is intended to provide information to consumers that are concerned about lead contamination. If you are interested in obtaining a copy of this booklet to see if it would be of use in your community, please contact Rick Rosa of the Water Quality Bureau in Helena at 444-2406.

Construction Grants -- The Twilight Years

By: Scott Anderson
Water Quality Bureau

The long awaited passage of the 1987 Water Quality Act (Clean Water Act Amendments) signaled the beginning of the end of the Federal Construction Grants Program. The bill authorized 9.6 billion through fiscal year 1990 for grants. An additional 8.4 billion is authorized for the years 1989 through 1994 to create a revolving loan program. The years 1989 and 1990 are considered transition years whereas 50% of the federal appropriation will go towards grants and the remainder to the loan program. If Congress appropriates the full amount authorized (which rarely occurs), Montana will receive over 40 million dollars as its share of the 9.6 billion national appropriation. This amount is significantly less than Montana's predicted infrastructure needs for wastewater facilities.

The Clean Water Act Amendments did not drastically alter the Construction Grants Program from its present form. The federal share remains at 55% with innovative or alternative technology eligible for 75% grant participation. The new legislation permits design/build (turnkey) grants where communities with a project cost less than 8 million can advertise for one contract to design and construct a treatment facility. Funds have been allocated by the Act for development and implementation of non-point source management and demonstration projects. The Act authorizes the EPA to consider Indian tribes as states for the purposes of receiving and administering construction grants. The EPA and the Indian Health Service will conduct a 12-month survey to assess the sewage treatment needs of Indian tribes.

The creation of the state revolving loan program by the 1987 Amendments represents the most significant change in federal assistance programs since the Water Pollution Control Act of 1956. Although the program desirably creates a perpetual mechanism for financing wastewater systems, it also implements the intention of Congress to transfer the responsibility of financing wastewater facilities from the federal government to the states and municipalities. Many Montana communities are finding the cost of financing wastewater treatment very expensive even with 55% grant assistance. The use of 100% loans for financing may be cost-prohibitive for communities with major treatment needs except for larger cities where loans or bond funds are typically used.

Initially the federal loan money comes with several strings attached - essentially the same requirements as construction grants funds. Assistance for non-complying facilities is prioritized but needs in this area are expected to be minimal in

Montana by 1989. Eligible categories are expanded and future capacity can be financed. Interest rates on the loans will range from 0% to market rates with the term to be not more than twenty years. The loan funds can be used to finance wastewater facilities construction, refinance existing debt obligations, purchase bond insurance or "leverage" additional sources of revenue by pledging the funds as security. As money is paid back into the revolving loan fund, most of the federal requirements are lost. In the future, the fund should become a very accessible and competitive source of financing for wastewater facilities construction.

With most major projects completed in Montana, grant monies are now available for smaller and lower priority projects. Communities with needs are urged to contact the Water Quality Bureau at 444-2406 to be considered for grant assistance. The Construction Grants Priority List for fiscal year 1988 will be completed this fall and all projects must be shown on this list to be eligible for grant assistance.

MSAWWA is on the Move!!

The Montana Section of AWWA is now 190 members strong, up 7.3% from one year ago. These new members have joined us in recognizing the need to keep in touch with news in the water industry, and are aware of the individual benefits AWWA can provide. If you know any of these new members, give them a big welcome to the organization!

Alden Beard, Helena
Kurt Corey, Billings
Jan Cranor, Billings
Michael Eastwood, Billings
Richard Engle, Bozeman
William Greenfield, Helena
Kenneth Hammer, Kalispell
Kevin Hundert, Helena
Scott Nelson, Livingston
Abdullah Shokri, Bozeman
Dave Tegg, Helena
Ken Wegner, Billings
Jack Williams, Helena
Thomas Wing, Helena
Andrew Paslawsky, Whitefish

James Chelini, Butte
Richard Cottingham, Helena
Henry Elbrecht, Helena
Dean Elliott, Bozeman
William Enright, Billings
Lyle Griffiths, Helena
Thomas Hansen, Missoula
Curtis Myran, Miles City
Earl Park, Lewistown
Dave Schneiter, Billings
Clint Tinsley, Livingston
Stuart Wiles, Helena
Steve Wimpheimer, Billings
Larry Woodward, Bozeman

We owe a big **THANK YOU !** to all our recruiters for signing these folks up. The larger we grow, the more we can offer our members here in Montana, and the more clout the National Association will have as they work to represent us and protect the water industry's interests. Recruiters of these new members were:

Ronald Klimko (1)
Michael Jacobson (1)
Andy Hyde (1)
Ralph Jerla (1)
Larry Larsen (1)

Howard Peavy (1)
Charles Dickert (8)
Jan Cranor (2)
Mike Patterson (1)
Donna Howell (2)

Electrical Maintenance

By: C. Thomas Wooters
Environmental Resources Training Center
Southern Illinois University at Edwardsville

Reprinted with permission from the Environmental Protection Agency, Springfield, IL

The ability to forecast electrical shorts is not an exact science, but shorts can be predicted in some instances. An insulation tester (megger) is a tool that can be used to help prevent a short before it occurs. A megger can also show a loss of electricity within a motor and/or the leads to that motor. The cost of one motor rewinding will offset the cost of the megger, plus some change. The hassle of downtime, when you do not expect it or at a time when you need that particular piece of equipment, can sometimes be alleviated by using some preventive maintenance.

A megger is useful in both water supply and wastewater treatment plants. It can measure the resistance through insulation to ground. Many leads to motors are placed in buried conduits. Since buildings are subject to periodic flooding and conduits do not always stay sealed, the lines often lie in water for years. This can add to deterioration of the insulation on the wire. Motor insulation can deteriorate from age, heat and normal wear. It is difficult to determine the exact time a short will occur. Insulation on wiring will deteriorate naturally over time until the flow of electricity that is being lost produces enough heat to speed up the rate of deterioration. As the insulating power of the material deteriorates, some of the electricity leaks through to ground where it is wasted. When the loss is severe enough, a dead short occurs.

A megger is an extended ohmmeter. It can produce 250 to 50,000 volts D.D., depending upon the model. The major difference between an ohmmeter and a megger is that an ohmmeter is used to check continuity through a circuit, but a megger is used to measure the resistance to the flow of electricity through an insulator. The positive line on a megger is attached to the wire for testing. The negative, or ground line, is placed on any metal surface that is grounded. If the insulation on the wire is poor, electricity will flow to ground and the megger will read resistance between the two points. If the wire is well insulated, the megger will read infinity - the closer to infinity, the better the insulation. One of the unique properties of a megger is its ability to produce a voltage comparable to that in the circuit during operation. The rate at which electricity is leaking from that circuit is better simulated. Also, the amperage generated by a megger is low and the probe will produce a small shock if touched. The low amperage draw makes the megger a relatively safe instrument, but be sure to follow the manufacturer's usage procedures for complete safety.

When meggering a motor's insulation, you can energize any of the leads to the stator. The resistance reading you obtain will tell you the possible leakage from the stator to ground. Another problem occurring in motors is a short that develops between stator windings. It is impossible to predict this situation with the motor and source lines connected. The only way to check insulation between windings is to isolate each winding or part winding against each of the remaining windings.

For example: If you have a 3-phase Wye wound motor, you would have to disconnect all nine wires inside the motor's terminal box. Place the ground wire of the megger on L_1 or L_4 and energize L_2, L_3, and L_7 one at a time and note the meter reading. If a short is developing, a low megaohm reading will occur.

Since this type of preventive maintenance is time consuming, most operators will not perform the test.

Megger readings can be misleading at times. What is a good or bad reading? When is it time to re-dip a stator? Doesn't an amp check tell you that a short is developing? These are valid questions and there is no exact answer. Let's look at each question and try to determine some answers.

1. What is a good or bad reading? Many electricians will use a rule of thumb that 1 M (megahohm/1HP) is okay. This rule may be fine for old motors that were dipped with poor insulators, but new motors have better insulation. Another rule of thumb is that not less than 100 M is a good reading.

2. When is it time to re-dip a stator? If you have never tested this motor before, the question is hard to answer. A new motor should read infinity and deteriorate slowly at each six months testing. As the insulation begins to create an excessive amount of heat, the insulating power deteriorates faster. You may have a 100 megaohm/6 month drop, and all of a sudden a 400 megaohm drop occurs. A short is developing. If the motor has never been tested, its track record is not proven. Some electricians use the "not less than 100 megaohm reading" as their guide.

3. Does an amp check show a developing short? Yes, an amp check that shows an increase of amp draw indicates a short. The only problem with amperage increase is that the short has already developed and the equipment is developing too much heat. This leads to another question - do heaters and breakers protect you from stator burn-out? They are made for that, but in real life, motors still heat up for a number of reasons.

In summary, an insulation tester (megger) is another tool that the maintenance operator can use to make his job easier and more efficient. The cost of the megger is minimal in relation to a new motor and the time required to use a megger properly is only a few hours every six months to test each motor at your facility. The use of the megger can answer more questions about problems than it asks.

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Chemical & Microbiological Analysis of Wastewater Training Conference

On May 12-14, 1987, Northern Montana College and the Department of Health and Environmental Sciences co-sponsored a training conference on the Chemical and Microbiological Analysis of Wastewater. The main instructors of the workshop were John Hawthorne and Jan Baker, both of the Department of Health and Environmental Sciences. Other instructors included Dick Pedersen, Water Quality Bureau, Martha Dow and Doris Roberts, Northern Montana College.

We hope to sponsor more workshops encompassing basic and advanced laboratory procedures. If any operator has an area that they would like presented in a laboratory workshop (water or wastewater), please let us know. Send your suggestions to:

Doris Roberts
Hagener Science Center
Northern Montana College
Havre, MT 59501

Back Row (L-R) Tony Shipp, Miles City; Fred Wendt, Butte; Louis Blaskovich, Butte; John Vukovich, Butte; Bruce Park, Stevensville; Mark Richardson, Miles City; Don Hultgren, Kalispell; John McCracken, Colstrip; Bill Dean, Havre; Bob Mann, Laurel; Robert Salle, Great Falls; Les Deines, Laurel; Larry Miller, Colstrip; Bruce Asay, Livingston; Fred Baily, Helena; John Hawthorne, Chem Lab; Mike Hogan, Butte; Dick Pedersen, Water Quality Bureau

Front Row (L-R) Debbie Magilke, Billings; Bernard Wanger, West Glacier; Patrick Carey, Missoula; Donald Bruch, Missoula; Bill Demeyer, Billings; Bob Cottom, Dillon; Katherine Halzworth, Lewistown; Martha Dow, Northern Montana College; Not pictured Steve Smith, Whitefish

Scenes from the Lab School

There were 24 participants in the workshop. A few of the comments on the workshop made by participants were:

I'd like to see such a workshop program expanded and offered yearly.

Was able to correct many mistakes done in our lab by working through correct procedures.

Thanks for the opportunity to participate in this needed training.

10 years is too long between lab workshops.

Extremely practical information.

Keeping Wastewater Submersibles Safe & Reliable

Reprinted with permission from Water Engineering & Management, April, 1987.

The safety and reliability of submersible wastewater pumps have been well demonstrated and documented. These two characteristics are the most striking advantages derived from specifying submersible solids-handling pumps for municipal and industrial wastewater applications. However, neither can be taken for granted and must be given appropriate consideration in any maintenance management plan or safety program.

Submersible wastewater pumps first came to the U.S. about 1955, having been introduced before that in Europe. In the early 1960's, when a guide rail system was developed to lift them out of their pit locations for repair and maintenance, an increasing number of design consultants and users became aware of the safety and other advantages of submersible units.

These pumps are widely used today for wet-well lift stations in sanitary wastewater collection systems, in other municipal situations, and in many industrial applications. They can handle 2-1/4 inch and larger solids, and for this duty have a minimum 3 inch discharge port. The pumps operate completely submerged in the wastewater they are pumping. They are flood-proof, and can be easily removed for repair and maintenance. The clever but simple guide rail system ended the dirty and sometimes dangerous task of sending personnel into the wet-well to maintain or repair the equipment.

A typical submersible pumping system consists of the pump-motor units together with the containment structure or station, automatic electrical controls, guide-rails, piping, valves, access frames and covers. This is shown in the cutaway diagram.

Wet-well installation is a major advantage of the submersible wastewater pump. Only one pit is required and if field service is scheduled or replacement is needed, the pump is easily lifted to the surface on guide rails, usually with a hoist. When lowered into position, the pump's outlet flange automatically seats against the discharge piping. There is no need for wrenches or special tools, or for the serviceman to enter the wet-well.

Inspection and preventative maintenance are normally easy to accomplish. If carried out regularly they will ensure continued, reliable operation of the entire system. All stations, pumps and operating equipment should, however, be inspected without fail at least once a year, and more frequently under severe operating conditions.

Maintenance personnel can handle most of the service work on-site without entering the wet-well. All equipment in the lift station should be backed by manufacturers' service manuals. The material should be carefully read and understood when the equipment is installed and started up, filed, and then consulted whenever servicing is required.

Here are basic safety and maintenance guidelines recommended for lift station systems as excerpted from the "SWPA Submersible Sewage Pumping Systems Handbook."

Safety Precautions

To minimize the risk of accidents in connection with service work, the following rules--as well as all applicable laws, regulations and manufacturers' recommendations--must be followed. *Note and read all safety precautions before performing any operation or maintenance procedure.*

* Be aware of health hazards. Observe strict cleanliness.

* Be aware of the risk of electrical accidents.

* Check the explosion risk before welding or using electric hand tools in or near the station. Never weld or use electrical tools in the wet-well after it has been in operation.

* Make sure that all lifting equipment, when used, is in good condition.

* Provide a suitable barrier around the work area for example, a guard rail.

* Make sure that all personnel have a clear path of retreat.

* Use safety helmets, safety goggles and protective shoes or boots.

* All personnel working with sewage systems must be vaccinated against any diseases that can occur.

* Never work alone. If there is a reason to enter the wet-well, use a lifting harness and safety line.

* Before entering the wet-well, make sure there is sufficient oxygen and that there are no poisonous gases present.

Since sewage pumps are designed for use in liquids which can be hazardous to the health, make sure that all equipment has been thoroughly cleaned.

To prevent injury to the eyes and skin, observe the following rules:

* Always wear goggles and rubber gloves.

* Wash and rinse the pump thoroughly with clean water before starting work.

* Wash and rinse any components in water after disassembly and then dry thoroughly.

If you get hazardous chemicals in your eyes, rinse them immediately with running water for 15 minutes, and hold your eyelids apart with your fingers. Contact a doctor *immediately*.

If you get hazardous chemicals on your skin, remove contaminated clothes, wash your skin with soap and water, and seek medical attention *immediately*.

Recommended Inspections

Before starting work on any pump, make sure it is isolated from the power supply and cannot be energized. This applies to the control circuit as well.

One method is to tag and lock the control panel to let other personnel know that you are working on the station. Keep in mind that some systems have an override switch at the treatment plant or other buildings. Make sure that this switch is also off and tagged at the other building before you start working on the station.

After the pump(s) have been isolated from the power supply and pulled to the top of the station, the following inspection guidelines should be followed. The appropriate manufacturer's service manuals should be consulted in all cases.

Visible Parts On Pump And In Station

* Check for vandalism or other station damage.

* Make certain the access cover works properly. Check the hold-open device to ensure that it is engaged.

* Make certain that the guide rails are completely vertical.

* Check condition of the lifting eye, chains, hooks, and wire ropes.

* Make certain that all screws, bolts and nuts are tight.

* Replace or repair worn or damaged parts.

Pump Casing and Impeller

* If the clearance between the impeller skirt and the pump casing or wear ring exceeds the manufacturer's recommendations, it may be necessary to adjust the impeller or replace the wear rings.

* Wear on the outlet flange from the pump casing usually causes corresponding wear on the discharge connection.

* Follow the manufacturer's instructions for disassembly, inspection and reassembly of the impeller and volute. When it is disassembled, check the motor shaft, impeller and volute bore for wear or damage.

* Follow the manufacturer's instructions for disassembly, inspection and reassembly of the shaft seal. It must be clean and properly seated before reassembly.

* Always replace worn or damaged parts.

Electrical Insulation

Perform megger (insulation resistance) test between the pump motor leads and pump casing. A low-20 megohms or less-reading indicates moisture entry into the motor chamber or power cord, or other deterioration of the insulation system. Such problems should be corrected before a major breakdown occurs.

Oil Quantity and Condition

Oil-Filled Motors

* *Caution:* If there has been any leakage, the motor housing may be under pressure. Hold a rag over the inspection plug to prevent splatter when loosening the plug.

* Check the oil in both the motor housing and the seal cavity through the oil inspection plugs. The oil level may be low or emulsified (cream-like), which indicates that water has entered the cavity and a leak is present. One possible cause is an inspection plug which is not sufficiently tight. Check the sealing surface of the motor housing, the cable entry, and the condition of the shaft seal. Whatever the problem, correct it and make certain that the oil is refilled to the proper level.

Non Oil-Filled Motors

* If there is any liquid in the motor housing, a leak is present and all sealing faces should be checked as previously mentioned under Oil-Filled Motors.

Cable Entry

* Make certain that the cable connection is tight.

* If the cable entry leaks, it may be necessary to replace the cable seal. See manufacturer's manual for instructions.

* When refitting a cable which has been used before, even when the jacket is undamaged, always cut off a short piece of the cable so that the cable entry seal does not close around it at the same point.

* If the outer jacket of the cable is damaged, replace the cable. Make sure the cable has no sharp bends and is not pinched.

Controls

* Check liquid level sensors throughout their entire range of operation. Clean, adjust, replace and repair damaged equipment. Follow the manufacturer's instructions.

* The same procedure should be used for checking the balance of the control system. In particular, check signals and the tripping function, and make sure that the relays, lamps, fuses and connections are intact. Replace all inoperative equipment.

Piping and Valves

* Repair all flaws, and replace inoperative equipment.

Fault Tracing

A voltmeter, ohmmeter, and ammeter-together with the job wiring diagram-are required to test, measure and carry out fault tracing on electrical equipment.

Fault tracing must always be performed with the power supply disconnected and locked off, except for those checks which can be performed only with power.

Electrical work must be performed by qualified electricians and all local, state, and national safety regulations be followed. Observe the recommended safety precautions previously mentioned in this chapter.

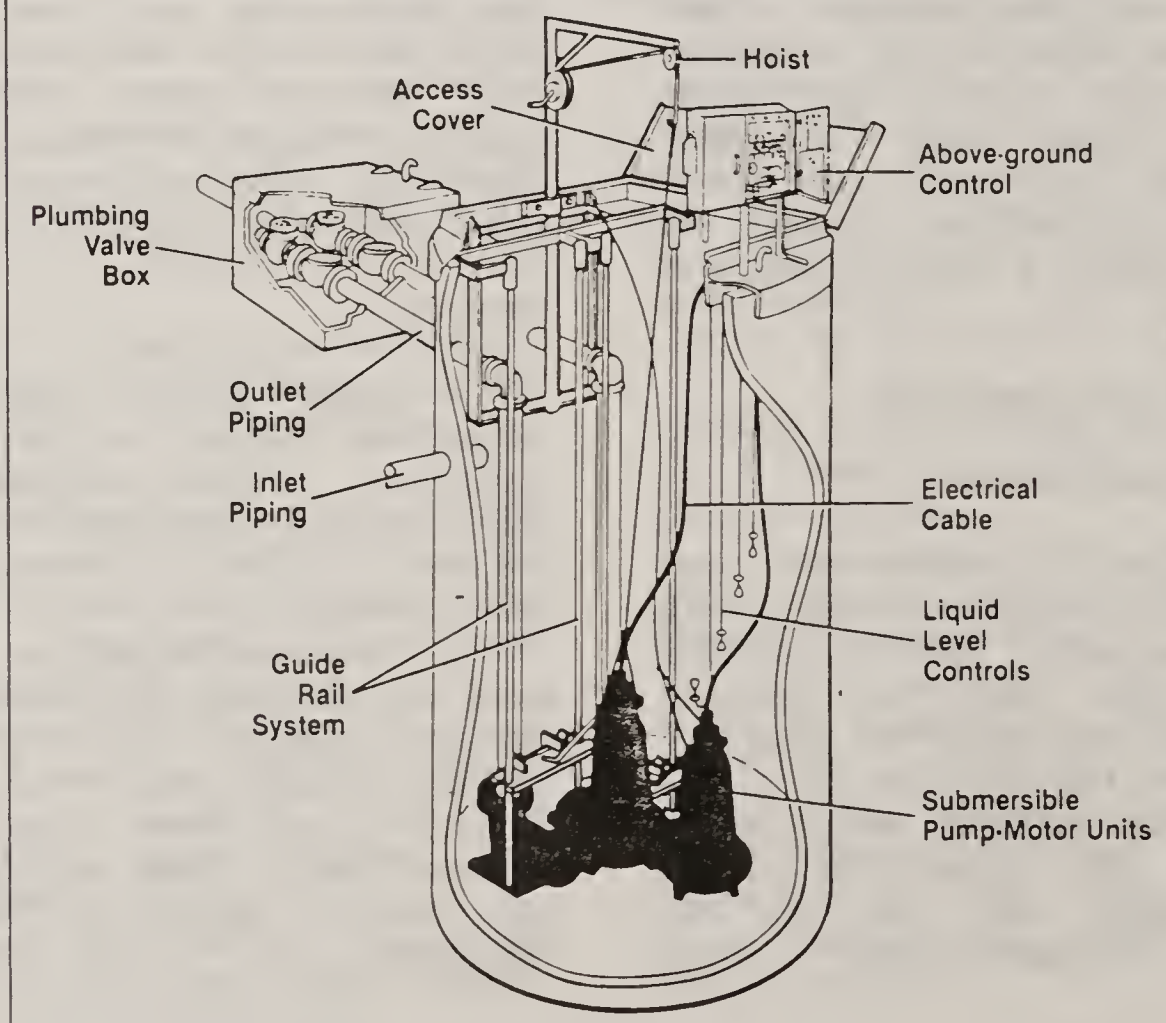
Major Servicing

Submersible sewage pumps can be serviced in the field at qualified facilities. If the pump is still in warranty, it should be serviced by an authorized shop.

Manufacturer's service manuals provide detailed instructions for replacement of impellers, stators, seals and bearings.

To facilitate field maintenance and service, many manufacturers provide a list of authorized service facilities, recommended spare parts, and the maintenance equipment required.

Cutaway of typical lift station equipped with two submersible pumps.



The following is a testimonial for the necessity of meters in water treatment plants. The filtration plant in Devon began operation a couple of years ago and the operator for the system, Art Adamson, has been "fine tuning" the treatment process ever since. The plant is operated and maintained in excellent fashion and if you are ever on the Hi-line, stop by and have Art give you a tour.

Mechanical Meters in Water Treatment Plants

By: Art Adamson
Devon Water Superintendent

Water meters are one of the most important "tools" that water treatment plant operators have for processing raw water into potable water. Every treatment plant should have an influent (raw water) and an effluent (finished water) meter.

A water meter normally has a sweep indicator and a totalizer. The sweep indicator on the influent meter tells how many gallons per minute you are processing through your filters. A controlling valve before the meter is used to keep your flow rate into the filters within the guidelines of the manufacturer. The totalizers tell you how many gallons per day you processed and the difference of the influent and effluent meters tells you how many gallons were used for backwashing.

Meters are accurate if they are installed according to the manufacturers' specifications. In order to keep them accurate and in proper operating condition, plant operators must perform a regular maintenance program as recommended by the manufacturer. The influent meter may need more frequent maintenance because the raw water is dirtier and the propeller and housing may build up with "mud". Not only may the mud prevent proper lubrication of water lubricated bearings, but it coats the propeller and housing, making the water passage smaller. This increases the flow rate and as it increases, the propeller turns faster and the meter reads high. This should be considered in the design of a water treatment plant and you should never have any chemicals added before the influent meter.

If your water meters in your filtration plant quit, it will be like trying to operate your water plant in the middle of the night without any lights.

Iron & Manganese Removal From Ground Water

By: Nilaksh Kothari
HKM Associates - Billings, MT

INTRODUCTION

Iron and manganese are natural constituents of the earth's crust and both elements create serious aesthetic problems in drinking water supplies. They are found in both surface and ground water; but are predominantly in ground water.

Frequent questions concerning iron and manganese are:

1. *How come some underground waters are relatively free of iron and manganese and others have so much?*

2. *Is there an economical method that can be used to remove or treat iron and manganese?*

3. *The well is about 10-15 years old. Why is the well losing its water producing capacity?*

4. *What are iron-bacteria?*

The objective of this paper is to answer some of these questions by reviewing: a) the occurrence of iron and manganese in ground water, b) problems caused by iron and manganese, c) different methods of iron and manganese removal from ground water, and d) factors affecting iron and manganese removal.

OCCURRENCE OF IRON AND MANGANESE IN GROUND WATER

Iron predominantly occurs in silicate minerals of igneous rocks. Manganese is found in metamorphic and sedimentary rocks. They exist in soil as insoluble forms of ferric oxide and manganese dioxide respectively. The concentrations of these elements in ground water is influenced by a) the physical and chemical make-up of the surrounding soil and rock, b) the geological structure of the soil and rock formation, c) the hydrological conditions of the area, and d) the presence of microorganisms. The chemical composition of the soil or rock and the presence of reducing conditions created by microbial activities are probably the most important factors for iron and manganese in ground water.

To understand the behavior of iron and manganese, it is important to know something about the chemistry of these elements. Iron usually exists in two oxidation states, divalent ferrous iron {Fe(II)} or trivalent ferric iron {Fe(III)}. Manganese can exist in any oxidation state from {Mn(o)} to (Mn(VII)}. Iron in the oxidation state of {Fe(III)} and manganese as {Mn(IV)} do not dissolve in water containing oxygen. Therefore, Fe(III) and Mn(IV) are considered as stable states of iron and manganese. However, in the absence of oxygen the insoluble forms of iron and manganese are reduced to the soluble forms of Fe(II) and Mn(II).

Water is deprived of oxygen as it percolates through the soil containing organic matter and aerobic organisms. Since iron and manganese remain soluble in the absence of oxygen, ground waters usually contain a higher concentration than surface water. However, once ground water is exposed to oxygen, the soluble compounds will form precipitates.

Biological reactions also represent an important mechanism in dissolving iron and manganese into ground water. Aerobic organisms produce carbon dioxide as a by-product, thereby adding carbon dioxide to the water. Carbon dioxide introduced into the water due to bacterial action lowers the pH of the water by converting the hydroxides to carbonates, carbonates to bicarbonates and bicarbonates to carbonic acid. The carbon dioxide produced may dissolve appreciable amounts of ferrous carbonate according to the following reaction:

$$FeCO_3 + CO_2 + H_2O \text{ --- } Fe(II) + 2HCO_3$$

NATURE OF THE PROBLEM

When iron and manganese are present in a water supply at concentrations exceeding the secondary drinking water standards of 0.3 mg/l and 0.05 mg/l respectively, they are objectionable for one or more of the following reasons:

1. *The precipitation of iron and manganese cause a reddish or brown-black color to water when exposed to air. The precipitate stains household utensils, porcelain plumbing fixtures and clothes.*
2. *Iron and manganese impart a metallic or bitter taste to water.*
3. *Water containing iron and manganese interferes with industrial processes such as laundering, paper-making, film processing, bleaching and dyeing.*
4. *Home softeners can become clogged by the precipitates of iron and manganese and thus reduce softener efficiency.*
5. *Deposition of iron and manganese precipitates in the distribution system can reduce the pipe diameter and eventually clog the pipe. The deposits in the water main can be resuspended by increased flow rates, thus causing high turbidities. Frequent flushing may be necessary.*
6. *Iron and manganese provide a food supply for the growth of bacteria in the water mains. When these organisms die and slough off, bad odors and unpleasant tastes may be produced. Iron bacteria grow on well screens, thus reducing the well yield.*

IRON AND MANGANESE REMOVAL METHODS

In 1874 at Charlottenburg, Germany, the first iron removal plant was constructed. The first plant to remove manganese along with iron was constructed in 1889 at Zutphen, Holland. The first plant for iron removal in the United States was constructed in 1893 at Atlantic Highlands, New Jersey. In Montana, the first iron and manganese removal plant was constructed at Glasgow.

The removal of iron and manganese from ground water can be achieved by several methods. The type of treatment will largely depend on the character of the water. An overview of the methods commonly used for the removal of iron and manganese from ground water is presented in Table I.

TABLE I
OVERVIEW OF IRON AND MANGANESE REMOVAL METHODS

Method	*Description*
Direct Oxidation	*Aeration followed by filtration*
	Aeration, detention and filtration.
	Aeration, oxidation aide and filtration.
	Aeration, addition of lime and filtration.
Addition of Oxidation Agents	*Chemical addition of chlorine, hypochlorites, potassium permanganate or ozone.*
Ion Exchange	*Removal using an ion exchange medium such as manganese greensand.*
Stabilization	*Sequestering and holding iron and manganese in the water.*

The following is a brief summary of the methods presented in Table I.

1. Direct Oxidation (Aeration)

One of the commonly used methods for removal of iron and manganese is the introduction of oxygen to the ground water (aeration). Aeration alone is usually effective in the removal of iron when followed directly by filtration, provided that there is little or no manganese present.

When both iron and manganese are present, aeration by itself is ineffective as precipitation is not instantaneous. Therefore, detention time is usually necessary following aeration and prior to filtration. The time required for the reaction to occur must be determined for each individual water to avoid problems with insufficient reaction time.

Iron and manganese in carbonate bearing waters can be precipitated by the addition of lime or soda-ash. Precipitation of these elements requires the pH of the water to be raised to about 11 units.

2. Addition of Oxidizing Agents

In comparison to iron, the rate of oxidation for manganese is slower in the normal pH range of natural waters. In addition, the presence of organic compounds in water may slow the oxidation process when only aeration is used. Oxidizing agents such as potassium permanganate, chlorine, hypochlorites, chlorine dioxide, and ozone are used when: a) conventional water treatment is not satisfactory, b) organic compounds interfere with iron and manganese removal, and/or c) the need for a higher quality water is desired.

a. Chlorine

The oxidation of iron and manganese is usually complete within one to two hours after the introduction of chlorine. A pH in the range of 6.8 to 8.4 units is required for oxidation. However, both chlorine and hypochlorite processes have limitations. These limitations are: a) doses of chlorine higher than the theoretical amount are required, b) oxidation using chlorine and hypochlorites is not always effective for removal of manganese where these elements are organically bound, and c) chloro-derivatives of organic compounds can be formed which cause taste and odor problems and have been shown to be carcinogens in test animals.

b. Potassium Permangante

Potassium Permangante is odorless, does not produce harmful vapors and can be handled safely with conventional methods. It is a stronger oxidizing agent than chlorine and chlorine compounds. Potassium permanganate oxidizes manganese within five minutes over a broad pH range. Therefore, five minutes may be considered as a minimum detention time, unless organic matter is present, which may require longer detention times.

Potassium permanganate is usually fed into a reaction basin to allow oxidation to occur. When a reaction time of more than five minutes is allowed in the reaction basin, the oxidized iron and manganese will settle in the basin, thus reducing the load on the filters.

c. Ozone

Ozone is an unstable, three-atom form of oxygen. It is pungent and faintly blue in color. Ozone can oxidize iron and manganese as well as the other organic materials that interfere with oxidation. The advantages of using ozone are: a) ozone precipitates iron and manganese very effectively, b) the potential for formation of trihalomethanes is reduced, c) the chlorine demand for disinfection is reduced, d) ozone effectively reduces taste, odor and color, and e) it destroys organic pollutants. The disadvantages of using ozone are: a) the inability of ozone to maintain a residual in the distribution system, b) ozone must be produced on site, therefore requiring elaborate equipment, and c) ozone is generally more expensive than chlorine.

3. Ion Exchange

Manganese greensand is a purple-black media processed using a natural mineral called glauconite. As glauconite is green and granular like sand, it is also called greensand. However, the greensand used today is generally high capacity synthetic resins which have the same form as natural greensand, but are impregnated with manganese oxide.

A manganese greensand filter bed is similar in operation to a zeolite water softener. In a manganese greensand filter, instead of sodium chloride (NaCl), potassium permanganate is used for greensand regeneration.

Manganese greensand has the capacity to receive the iron and manganese cations as water passes through the filter bed. The precipitated iron and manganese adhere to the grains of manganese greensand. This means that the greensand can oxidize iron and manganese until it becomes saturated with these electrons. Therefore, regeneration of greensand is required as the capacity to receive electrons is exhausted. The two modes of regeneration are: a) intermittent regeneration, and b) continuous regeneration.

The greensand exchange capacity is restored in intermittent regeneration by removing the filter bed out of service, washing it, regenerating with a solution of potassium permanganate and returning the filter back to service. All these sequences require about an hour.

With continuous regeneration methods, potassium permanganate is continuously fed to the filter, thus a disruption in plant operation is not required. The feed rate with continuous regeneration is established by setting the potassium permanganate high enough so that the filter effluent turns light pink. The dose is then cut back so that the effluent becomes clear.

The choice between intermittent and continuous regeneration methods depends on the concentrations of iron and manganese in the ground water. A manganese greensand system when properly operated will typically provide an effluent that contains less than 0.1 mg/l of iron and 0.01 mg/l of manganese.

The problems with an ion exchange method are:

a. If water contains dissolved oxygen, it will oxidize Fe(II) to a form that will pass directly through the filter bed. This is called iron fouling.

b. *The precipitated iron and manganese product adhere to grains of manganese greensand. The net effect is a gradual increase in the bulk volume of the filter.*

c. *Compared with other media, manganese greensand beds have shorter lives due to a breakdown of greensand by pressure or mechanical abrasion during backwashing.*

d. *When greensand is used without a layer of anthracite coal on top, the greensand clogs much faster due to the relatively small size of greensand grains.*

4. Stabilization

The method of stabilization is generally employed when the combined concentration of iron and manganese is less than 1.0 mg/l. This method is based on the agglomeration of the individual tiny particles of iron and manganese. For stabilization to be effective, polyphosphates should be applied before the oxidation of iron and manganese occurs.

As iron and manganese are not removed from solution by the stabilization method, there are several situations which make it unsuitable for use. a) There is always the potential for incrustation in the distribution system, b) When the concentration of iron and manganese exceed 1.0 mg/l, stabilization is uneconomical, c) If the water is heated, the polyphosphate reverts to orthophosphate; thus losing its properties, and d) The presence of phosphorous may stimulate bacterial growth in the water distribution system.

FACTORS AFFECTING IRON AND MANGANESE REMOVAL

Both the physical and chemical characteristics of water affect the removal of iron and manganese from ground water. They are:

a. *At higher water temperature, the oxidation rate is faster whereas at a lower water temperature the oxidation reaction is slow.*
b. *Detention time following oxidation will determine how complete the reactions occur.*
c. *At low pH, the oxidation reaction will be slow as compared to high pH.*
d. *The presence of organic matter with iron and manganese will slow the oxidation process.*
e. *The more dissolved oxygen in water, the faster the oxidation reaction.*
f. *The solubility of iron and manganese is altered due to the presence of chlorides, nitrates and phosphates.*
g. *High alkaline waters have low iron and manganese concentrations.*
h. *Cations tend to accelerate the oxidation reactions of iron and manganese.*

The above factors affect the removal methods differently and for these reasons, laboratory testing and studies should be made in evaluating the treatability of a water supply for iron and manganese removal.

Operator Certification Corner

1. *Which of the following conditions, when found in a water supply, would tend to increase the corrosiveness of the water on metals?*
   a. *high alkalinity*
   b. *high dissolved CO_2 content*
   c. *low dissolved O_2 content*
   d. *low dissolved mineral salts*

2. *Anabaena can cause what undesirable characteristic in water?*
   a. *color & decomposition*
   b. *taste & odor*
   c. *evaporation & contamination*

3. *A pump may be damaged if it is started with the discharge valve closed, if the pump is*
   a. *a positive-displacement pump*
   b. *a turbine pump*
   c. *a centrifugal pump*
   d. *an axial flow pump*

4. *Corrosive chemicals are usually pumped with a*
   a. *plunger-type pump*
   b. *piston-type pump*
   c. *rotary-type pump*
   d. *diaphragm-type pump*

5. *The production from a well was increased 30 percent. The pumping level decreased by 10 feet. Which of the following statements is true?*
   a. *the well will eventually fail*
   b. *a new pump will be needed*
   c. *operating costs will increase*
   d. *no effect*

6. *Which of the following are factors that determine the amount of hydrogen sulfide produced in a sewer?*
   a. *anaerobic conditions*
   b. *flow velocity*
   c. *pH*
   d. *temperature of wastewater*
   e. *all of the above*

7. *Air is dissolved into the wastewater in the aeration tank. What is the purpose of this?*
   a. *encourage the growth of anaerobic organisms*
   b. *promote the breakdown of organic materials*
   c. *decrease chlorine concentration*
   d. *provide nitrogen for the microorganisms*

8. *The principal purpose of sludge digestion is to*
   a. *reduce the volume of sludge*
   b. *produce gas*
   c. *produce a humus fertilizer*
   d. *none of the above*

(Answers on back page)

AWWA RESEARCH FOUNDATION

Wastewater Reuse: What is the Foundation's Role?

The American Water Works Association Research Foundation, as directed by its Board of Trustees, is emphasizing its role as a technology transfer agent in the field of water reuse.

The Foundation sees water reuse as a major tool for reducing dependence on water supplies that can be used to produce potable water. Only a small fraction of the water used by a municipality need be of potable quality, particularly in areas where urban landscapes must be irrigated extensively. In the case of industrial and agricultural water use, the water seldom needs to be of potable quality or needs to come from a source that can easily be made potable. These nonpotable demands can be met effectively by the use of reclaimed water.

To promote the use of reclaimed wastewater for purposes not requiring potable water (municipal, industrial and agricultural), the Foundation publishes a bi-monthly newsletter (Water Reuse Newsletter) and administers major tri-annual Water Reuse Symposia that attract practitioners and would-be practitioners of wastewater reclamation and reuse from throughout the world.

The reclamation of wastewater to a quality that can be used directly as potable water is being researched extensively and these efforts are also followed closely by the Water Reuse Newsletter and by the Water Reuse Symposia. The indirect use of reclaimed wastewater as a potable supply, where the reclaimed water is percolated to a groundwater supply or a surface reservoir, is also closely monitored.

If your organization reuses water (even through the use of an upstream city's discharge) or could benefit from the reuse of water, you can keep current by subscribing to the Water Reuse Newsletter and attending the Water Reuse Symposia.

PLEASE SEND: One free trial copy of the Research Foundation's **WATER REUSE NEWSLETTER**

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